DOCUMENT RESUME

ED 242 555 SE 044 356

AUTHOR Stafford, Alva R.
TITLE Earth Science, Grade 8. Part 1. Curriculum Bulletin Number 81CBM58.
INSTITUTION Houston Independent School District, Tex.
PUB DATE 81
NOTE 237p.
PUB TYPE Guides - Classroom Use - Guides (For Teachers) (052)

EDRS PRICE MF01/PC10 Plus Postage.
DESCRIPTORS Behavioral Objectives; Content Area Reading; Curriculum Guides; *Earth Science; Grade 8; Junior High Schools; Science Activities; Science Education; *Science Instruction; *Secondary School Science; *Teaching Methods
IDENTIFIERS Texas (Houston)

ABSTRACT

This curriculum guide is designed for use with the Charles E. Merrill textbook "Focus on Earth Science" and with the laboratory manual, teaching guide, and student review and reinforcement guide which accompany the textbook. Suggested time allotment, major concepts, instructional objectives, assessment items, available materials (such as films, charts, models, and transparencies), and suggested activities are provided for chapters 1 to 11. These chapters focus on the nature of earth science; views of earth; earth-moon systems; matter; minerals; high temperature and pressure rocks; weathering and sedimentary rocks; air; seasons, climate, and water; oceanography; and on circulation of ocean waters, waves, and tides. Enabling objectives for essential learner outcomes, basic objectives which each teacher must teach but not requiring 100 percent student mastery, assessments and activities requiring minimal reading skills, and assessments and activities for accelerated students are noted when applicable. Additional information provided in the guide includes: a list of essential learning outcomes; earth science scope and sequence chart; comments on safety precautions, outline and outlining strategies, and techniques in teaching reading of science; a list of elementary school earth science objectives; and a table of prefixes, suffixes, and root words. (JN)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED242555

EARTH SCIENCE

GRADE

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

- Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Sarah Abbott

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

PART I

SE044356

Houston Independent School District
Houston, Texas

Curriculum Bulletin 81CBM58

Item Number 33.3470

EARTH SCIENCE

GRADE 8

PART I

Curriculum Bulletin Number 81CBM58

Prepared by

Alva R. Stafford
Clifton Middle School

With Contributions from

Alvin E. Coleman, Williams Middle School
Howard L. McLaren II, Revere Middle School
Sandra Magee, Revere Middle School
Peggy Moore, Woodson Middle School
Jean Sitterle, Johnston Middle School
Della S. Webb, Marshall Middle School
Larry Williams, Holland Middle School

Published by

Houston Independent School District
Houston, Texas
1981

Prepared Under the Direction of

Mr. Lawrence Cook, Assistant Superintendent, Instructional Support Services
Ms. Marcille Hollingsworth, Director, Science Department
Mrs. Roberta Brisco, Assistant Director, Curriculum Publications

Board of Education

Mrs. Marquis (Blue) Alexander, Jr., President
Mrs. Bobby Ann Peiffer, Vice President
Mr. Ray Morrison, Secretary
Dr. James C. Jones, Assistant Secretary
Mr. Tarrant Fendley
Mr. Wiley E. Henry
Mr. Louis A. Harris

Administration

Mr. Billy Reagan, General Superintendent
Dr. Michael Say, Superintendent, Instruction and Support Services
Mr. Lawrence Marshall, Deputy Superintendent, General Instructional Services
and Alternative Education

FOREWORD

We live in a world profoundly affected by science and technology. Students in the eighth grade need to be nurtured tenderly to maintain their interest in science and to develop skills that will serve them in further educational development. Let's all work to make this beginning truly an "eye and mind opening" experience rather than a collage of facts that leaves students looking toward the end of the tenth grade when they can be "through with science."

The texts that we use were written for courses designed for one year of instruction; guard against the tendency to try to teach too much simply because it is there. Make the most of the copious materials to choose those topics and activities most appropriate to the skills and interests of the students in individual classrooms. Be more concerned with skills--communication, observation, data collection and interpretation, prediction--rather than with the retention of facts. This course of study prepared by a group of teachers was written to assist you to do this.

For this age student, the process of how the student learns is more important than what he learns. Your classrooms should be filled with things of interest. It should show student involvement. Display their projects, pictures of planets, pictures of the earth's surface, minerals, etc. Each class period should involve some type of laboratory activity and students must be participants, not spectators.

You are encouraged to use all current materials you can obtain. You are especially encouraged to use those elements in the child's environment which are relevant. Emphasis should center around the total ecology of our environment and a student should leave the science courses with an appreciation for all ecological relationships.

You are teaching science. Hopefully you are in your classroom because you like science and also young people. When these eighth graders finish this course, will they like science and you?

Marcille Hollingsworth
Director, Science

Printed by
HISD Printing and Publications Department

ABOUT THIS GUIDE

During these times of competence based learning and the requirements of certain essential learning objectives, the responsibilities of the science teaching profession are tremendous. The problems of the different levels and rates of learning of students make our jobs more difficult.

The function of this guide is to help the classroom teacher overcome some of these difficulties. The teacher should realize that this guide should be used with flexibility to encompass his own particular students and classroom situations.

This curriculum guide is covered by the Merrill textbook, Focus on Earth Science, and the Activity-Centered Program, The Learning Strategy For the Laboratory, and Review and Reinforcement Guide, which go with this text. These will be referred to as the Activity Book, as the Lab Manual, and as the Review Book. The extra activities been placed with the appropriate chapters or at the end in the appendix. These activities have been added so that they may be reproduced in each school as needed.

Each chapter has been developed with major concepts, instructional objectives, assessments, available materials (films, charts, models, transparencies, etc.) and suggested activities. The chapters were set up in this particular pattern to allow continuity of the curriculum, flexibility for the teacher's planning and a variety of fun and interesting activities presented and should use discretion in his selections of these activities.

Special symbols have been placed by certain objectives, assessments, and suggested activities. Knowing there is not a "typical student" the planners of this guide tried to simplify methods of teaching those students with learning disabilities and to provide additional goals for those students with advanced learning skills.

The code is as follows:

e - enabling objective for an essential learner outcome

B - Basic objectives which each teacher must teach but 100% mastery is not required of the student

- unmarked objectives are optional and may be used as time permits to meet special needs of students

* - assessments and activities requiring mininal reading skills

@ - assessments and activities for accelerated students

ESSENTIAL LEARNER OUTCOMES

EARTH SCIENCE

Grade 8

The student will-

Given a list of objects and activities and a list of the four major earth sciences, indicate which of the sciences would be involved in the study of each object or activity.

Given a map of the Gulf of Mexico and the latitude and longitude of a hurricane at four different times, plot the movement of the hurricane during that period of time.

Given a ball, demonstrate and explain the action of gravity and describe what would happen if there were no force of gravity on the earth.

Given a list of the time zones for the United States, place Houston, New York City, Los Angeles, and Denver in the proper time zone.

Given the statement, "The portion of the moon we can see is that portion in the sunlight," use a globe, flashlight, and a ball or illustrations to explain the phases of the moon.

Given samples or pictures with obvious characteristics, such as gold, silver, mercury, copper, limestone, sandstone, marble, granite, diamonds, rubies, emeralds, quartz, sulfur, galena, talc, halite, etc., identify at least ten different rocks and minerals.

Name three substances obtained in commercial quantities from the earth that are found within 100 miles of Houston.

Given a globe and a flashlight, explain how the tilt of the earth as it rotates on its axis is responsible for the change in the weather during the seasons.

Recognize threatening weather conditions and suggest appropriate precautionary actions.

Describe one way each that wind, moving water, and freezing water (or ice) can change the surface of the earth.

Describe how a volcano and an earthquake can change the surface of the earth.

Compare a planet with a star.

Given a balloon, demonstrate and explain Newton's Third Law of Motion, "For every action, there is an equal and oppposite reaction," and explain how this law applies to a rocket lifting off the ground.

List at least two conditions that exist on planet earth that enables life as we know it to exist.

BURKE BAKER PLANETARIUM

All students who are enrolled in Earth Science should be scheduled for a field trip to the Burke Baker Planetarium. It is appropriate that students be studying Astronomy at the time the field trip is made. The Planetarium seats 232; there are two sessions per day, and the Houston Independent School District may send students on Tuesday, Thursday, and Friday. Every effort will be made to see that the field trip and study of Astronomy coincide.

Students in junior high schools and middle schools during the first year of transition (teaching Earth Science for one semester for the last time) will be scheduled for the Planetarium visits during November and December. Those schools scheduled to make the Planetarium trip in November should teach Unit VIII, The Universe, before Unit V. Those schools scheduled to make the Planetarium trip in December should teach Unit VIII before Unit VII.

Students in the middle schools who are taking Earth Science for two semesters will be scheduled to visit the Planetarium in April. They should have Unit VIII before Unit VII. This will complete the field trips before late May and will avoid conflicts.

BE SURE TO ALTER THE SEQUENCE OF YOUR INSTRUCTION TO MAKE THE STUDY OF ASTRONOMY COINCIDE WITH THE PLANETARIUM FIELD TRIP.

Table of Contents

Page

Foreword iii
About This Guide iv
Essential Learner Outcomes v
Burke Baker Planetarium vi
Scope and Sequence 1
General Information 3
Safety Precautions 3
Storeroom and Supplies 4
Use of Library and Supplementary Resources 5
Outline and Outlining 7
Techniques in Teaching the Reading of Science 9
Essential Learner Outcomes - Elementary 10
Science: An Appropriate Vehicle for Developing Reading Skills 13
Table of Prefixes, Suffixes, and Roots 17
Laboratory Information 22
Pictures of Laboratory Equipment 23
Materials 26
Unit I: Earth Science 27
- Chapter 1: Earth Science 27
- Chapter 2: Views of Earth 47
- Chapter 3: Earth-Moon System 59

Unit II: Earth's Moon 98
- Chapter 4: Matter 98
- Chapter 5: Minerals 122
- Chapter 6: High Temperature and Pressure Rocks 137
- Chapter 7: Weathering and Sedimentary Rocks 146

Unit III: Earth's Air and Water 156
- Chapter 8: Air 156
- Chapter 9: Seasons, Climate, and Water 169
- Chapter 10: Oceanography 194
- Chapter 11: Restless Waters 211

EIGHTH GRADE

EARTH SCIENCE

TWO SEMESTERS

	SCOPE AND SEQUENCE	TIME ALLOTMENT
UNIT 1	Earth Science Chapter 1 - Earth Science Chapter 2 - Views of Earth Chapter 3 - Earth-Moon System	24 days
UNIT 2	Earth's Matter Chapter 4 - Matter Chapter 5 - Minerals Chapter 6 - High Temeprature and Pressure Rocks Chapter 7 - Weathering and Sedimentary Rocks	32 days
UNIT 3	Earth's Air and Water Chapter 8 - Air Chapter 9 - Seasons, Climate, and Weather Chapter 10 - Oceanography Chapter 11 - Restless Waters	29 days
UNIT 4	Earth's Surface Processes Chapter 12 - Erosion, Mass Movements, and Wind Chapter 13 - Water Systems Chapter 14 - Glaciers, The Work of Ice	21 days
UNIT 5	Earth's Internal Processes Chapter 15 - Earthquakes Chapter 16 - Plate Tectonics Theory Chapter 17 - Landforms	23 days
UNIT 6	Dating Geologic Time Chapter 18 - Dating Geologic Time Chapter 19 - Earth Through Geologic Time	Optional
UNIT 7	Earth: Environment Chapter 20 - Renewable Resources Chapter 21 - Non Renewable Resources Chapter 22 - Energy Resources	21 days
UNIT 8	The Universe Chapter 23 - The Universe, Galaxies, and Stars Chapter 24 - The Solar System Chapter 25 - Space Voyages and Exploration	20 days

EIGHTH GRADE

EARTH SCIENCE

ONE SEMESTER

SCOPE AND SEQUENCE		TIME ALLOTMENT
UNIT 1	Earth Science Chapter 1 - Earth Science Chapter 2 - Views of Earth Chapter 3 - Earth-moon system	19 days
UNIT 2	Earth's Matter Chapter 4 - Matter Chapter 5 - Minerals Chapter 6 - High Temperature and Pressure Rocks Chapter 7 - Weathering and Sedimentary Rocks	15 days
UNIT 3	Earth's Air and Water Chapter 8 - Air Chapter 9 - Seasons, Climate, and Weather Chapter 10 - Oceanography Chapter 11 - Restless Waters	12 days
UNIT 4	Earth's Surface Processes Chapter 12 - Erosion, Mass, Movements, and Wind Chapter 13 - Water Systems Chapter 14 - Glaciers, The Work of Ice	10 days
UNIT 5	Earth's Internal Processes Chapter 15 - Earthquakes Chapter 16 - Plate Tectonics Chapter 17 - Landforms	10 days
UNIT 6	Earth's History Chapter 18 - Dating Geologic Time Chapter 19 - Earth Through Geologic Time	Optional
UNIT 7	Earth: Environment Chapter 20 - Renewable Resources Chapter 21 - Non-Renewable Resources Chapter 22 - Energy Resources	9 days
UNIT 8	The Universe Chapter 23 - The Universe, Galaxies, and Stars Chapter 24 - The Solar System Chapter 25 - Space Voyages and Exploration	11 days

GENERAL INFORMATION

There is NO laboratory fee for the eighth grade science student. However, each teacher in the Science Department will be reimbursed for expenditures up to $10.00 per year for incidentals provided itemized receipts are kept and turned in. This money should be used to buy materials not furnished by the District.

The Science Supply Center at the Central Warehouse keeps in stock some 1600 items that you may requisition as you need them. Your Science Department chairman has a copy of the catalog of science supplies and the requisition forms as well as the knowledge of how these are to be used. We have the materials and we want you to make full use of them as you see fit.

The District furnishes many live supplies that we maintain and ship through our school mail system. Your department chairman will have order blanks for these requests along with instructions for requisition.

Live cultures that we do not maintain must be ordered from a commercial supply house. The paper work to insure delivery requires that your requisition reach the Science Office at least three weeks before the planned delivery date. These may be purchased from the Science Office on the regular requisition form, but that requisition must not have any other warehouse items on the requisition.

Live specimen must be cared for properly when they reach your school if they are to remain alive until your students are ready to use them.

SAFETY PRECAUTION

The introduction of more and more chemistry into eighth grade science curriculum increases the opportunities for students to have accidents and makes imperative for science teachers to devote more time to the instruction for safe laboratory procedures.

Each teacher must devote adequate time and effort to the promotion of safety in the classroom and in the laboratory. A set of safety rules and regulations should be carefully worked out, and each student should be furnished a copy of these. Additional time should be spent impressing the rules upon the student. Such rules should be posted in the laboratory and the students instructed as to what should be done in case of an emergency. Following are some general instructions that are essential:

1. Safety goggles must be worn by students and teachers when performing hazardous experiments.

2. Never drink out of laboratory glassware.

3. The best object with which to smother a fire upon the clothing is a laboratory apron; a wet paper towel or cloth will smother a small fire on the desk top. Never attempt to blow out a fire or pour water on a chemical fire.

4. Instruct the students: When chemicals are spilled, dilute them with water. If a chemical is spilled on your body, wash the chemical off with copious amounts of running water.

5. Never allow the students to have access to stock quantities of chemicals; place all chemicals that the students will use in small bottles which are never returned to the stock shelf. Hazardous chemicals, in all quantities, should be kept in locked cabinets away from all students.

6. The teacher should never leave a class in the laboratory. If an emergency arises, the group should be returned to the classroom, or another teacher should be called in to supervise the laboratory.

7. The storeroom should always be locked when the teacher is away from the laboratory.

8. Students should not be allowed in the storeroom, except as laboratory assistants. Student assistants must always work under the direction and supervision of a teacher. Have each student who works as a laboratory assistant copy, date, and sign the following statement. It would be wise to have a parent's signature also.

> "Serving as a laboratory assistant is a privilege which requires responsible behavior at all times. I will perform only those experiments directed and supervised by a teacher and I will not permit others to perform unauthorized experiments.
>
> "I know that science supplies and equipment belong in the lab or storeroom. I will not take nor permit others to take such materials from the lab."

9. An adequate first-aid kit must be maintained and the teachers must be adequately trained in the proper procedures needed for the treatment of injuries. The school nurse will be glad to assist in establishing and maintaining excellent first-aid procedures.

It is the responsibility of the teacher to care for and maintain all equipment and to assist in maintaining a clean storeroom and laboratory. All materials should be returned to their proper storage place after use. Stock bottles of chemicals should never be placed in a position where students could possibly contaminate the chemical by returning wrong materials or using dirty instruments. Transfer the chemicals to smaller bottles so that if the chemical is contaminated, smaller amounts will have to be thrown away. All the teachers in a building must work together to insure that all groups have materials when they are needed and that equipment be available in good working order.

STOREROOM AND SUPPLIES

Every school has storage space for science equipment and supplies, and each school is adequately equipped with those supplies and equipment needed to carry on good instruction in science. Some system of responsibility must be worked out in each science department regarding maintenance of the storeroom and keeping the supplies and equipment in good order. The kind, quantity, and condition of equipment in each school reflect the initiative and general scientific attitude of the teachers in that building.

All science supplies in the building are for the use of any science teacher, regardless of the course taught. This policy has some modification, however, in the case of senior high school science courses, where each science has its own storeroom and supplies. Even here, there are times when a piece of physics equipment will lend itself well in supplying a need in the chemistry class or when some chemical is needed by the biology department. In these cases and other comparable ones, sharing is to be done.

It is imperative that science equipment be kept in good, clean condition and stored in an orderly way. When not in use, equipment should be cleaned and put into its proper place or storage in order to be ready for the next teacher who needs it. Science equipment is expensive, and all students should be taught respect for it. They should be instructed as to its proper use. Carelessness has no place in science, particularly in the laboratory.

In the use of materials, economy should be rigorously practiced. Avoid the mutilation of dissecting specimen. Certainly the teacher is expected to use sufficient quantities, and see that each student does the same. At the same time, wastefulness should be avoided. Many materials, after use, may be saved for later use. Mossy zinc, for example, after use should be washed and retained. Prevention of contamination is an important measure of economy. Students should not have access to the stock supply, but a portion of a chemical needed should be put into a separate well-labeled container for student use.

Except in the case of supervised student assistants, no student should ever have access to the storeroom. This rule should be adhered to rigidly. Student assistants should be under the supervision of the teacher at all times. Never should the storeroom remain unlocked when the teacher is not present. All dangerous chemicals should be stored that students never have access to them except under the most careful supervision.

All science departments are asked to make a thorough inventory of all equipment and supplies once a year. All shelves, containers, etc., should be cleaned at this time. All unusable containers and broken equipment should be discarded. Usable containers and shipping materials should be returned to the Science Supply Center, Central Warehouse.

USE OF LIBRARY AND SUPPLEMENTARY RESOURCES

Although each teacher should endeavor to have a supply of resource materials available in the classroom, the students should be encouraged to use the resources of the school library for further study. Learning how to seek out information in reference materials on what has been previously done and recorded is an important part of science instruction. This is a particularly valuable experience for students who are above average in their abilities.

One of the responsibilities of the science teacher is to assist the librarian in selecting new materials for the science section of the library and in training the students how to use the library effectively. The teacher should keep himself informed about the materials available in the library and should be alert for additional materials that could be added to the supply. A folder kept throughout the year for listing appropriate books and materials is a useful aid when the time arrives that the librarian asks for suggestions for making additions to the science section.

The teacher can make arrangements with the librarian for the class as a group to work for a full period in the library, or for sections of books to be reserved for a period of time, or for a number of books to be checked out and carried to the classroom for use, or for science book lists to be provided for reference purposes.

Topic Classification. Following is the science topic classification of the Dewey Decimal System which is used in the school libraries:

500	General Science	600	Technology
510	Mathematics	710	Medical Science
520	Astronomy	620	Engineering
530	Physics	630	Agriculture
540	Chemistry	640	Home Economics
550	Geology	650	Business
560	Paleontology	660	Chemical Technology
570	Biology	670	Manufactures
580	Botany	580	Other Manufactures
590	Zoology	690	Building Construction

Each student has a copy of Your Library, A Guide for Students and Teachers, a school district publication which is purchased in English classes. This publication supplies the student with full information about the use of the library.

Research Procedures: Following is an excerpt from page 47 of the new edition of Your Library:

Use of the Library in Research

Steps in Preparing a Research Paper

Step 1. Selecting and limiting the subject

Be sure that the subject is sufficiently narrow so that it can be covered adequately in the desired length of paper.

Step 2. Locating the possible sources of information

a. The basic library tools:
   The Card Catalog
   Encyclopedias
   Encyclopedia annuals and other year books
   The Readers' Guide to Periodical Literature
   The Information file (Vertical File)

b. Specialized reference books

c. Other books for information

Step 3. Skimming for information which bears on the subject

Step 4. Reading and taking notes that will aid in recall of essential information

Step 5. Outlining and writing the paper

Step 6. Compiling the bibliography

OUTLINE AND OUTLINING

An outline gives the main topics, or principal ideas, of a subject. It is a writer's blueprint, or plan, for an article, a theme, or a book. It may be used to summarize an article or a book for study, or to prepare a speech.

Formal outlines are of two kinds. The topic outline is a summary of topics and subtopics, or nouns and phrases, to indicate ideas. The sentence outline uses complete sentences for each division.

Organization: All topics of equal importance should be phrased in similar form and indented equally. The subject should be covered completely, but without too many main topics. Topic headings should be clear.

The topics and subtopics may be organized with Roman numerals (I), Capital Letters (A), Arabic numerals (1), and small letters (a), in that order. Use periods after the number and letters. If more subdivision is needed, repeat the numbers and letters in parentheses. Do not use periods after the parentheses. Always use at least two subheads. Capitalize the first letter of the first word of each topic and subtopic. Use periods after sentences.

A Sample Topic Outline Follows:

Outline on Floods

I. Definition of Floods
    A. Extent of Floods
    B. Effects of Floods
        1. Bad effects
            a. Destroys property and homes
            b. Carries off topsoil
            c. Causes injuries and deaths
        2. Good effects
            a. Creates fertile regions
            b. Transports soil
                (1) Nile Valley
                (2) Mississippi Delta

II. Kinds of Floods
    A. River Floods
        1. Commonly overflowing rivers
            a. Mississippi - Missouri system
            b. Hwang Ho, or Yellow River
        2. Causes
            a. Heavy rains
            b. Fast melting of snow and ice

TECHNIQUES IN TEACHING THE READING OF SCIENCE

The following are some ways in which students may be helped to learn the reading skills for science while, at the same time, learning content. Some of the suggestions given for reading in other content subjects may be adapted to science:

1. Provide a section of the classroom where attractive pamphlets, magazines, and books can be displayed. Quantities of excellent materials can be obtained free or inexpensively from industrial firms and government agencies. The materials usually provide a wide range or subject matter as well as reading difficulty. The American Association for the Advancement of Science and the National Science Foundation both publish material of considerable value for teaching.

2. Underline, number or write down the steps in a process.

3. Try to write the findings of an experiment in one sentence.

4. In material where there are many facts, try to determine the most important ones by the aids given by the author. Some of these aids are: listing of important terms, use of italics, amount of space given to discussion of any one fact, pictures, or diagrams.

5. Have the students explain the practical use of what they have learned.

Some other activities include:

1. Encourage careful, thoughtful reading of scientific materials. Rereading may be necessary. Rate of reading should be appropriate for doing exacting, analytical reading.

2. Help students read to follow directions, as when conducting a science experiment which involves a series of steps.

3. Help students learn the technical and special vocabularies of science.

4. Help students learn to read, to get meaning from, and to use equations, formulas, charts, schematic diagrams, abbreviations and symbols used in science.

5. Help students use the main ideas and details of science materials to derive generalizations and principles.

6. Help students learn to translate words into scientific symbols, formulas or equations.

7. Help students learn to translate science principles and relationships into appropriate formulas or equations.

8. Help students learn approaches to solving problems in science reading situations.

ESSENTIAL LEARNER OUTCOMES

EARTH SCIENCE ELEMENTARY

KINDERGARTEN

The pupil will -

1. Given a cubic, a ball, a box and a bean, pick out the one which resembles the shape of the earth.
2. When shown a picture of a definite seasonal activity or change, give the name of the probable season.

GRADE 1

The pupil will -

1. When shown pictures of objects, point out those which are solids, those which are liquids, and those which are gases.
2. When shown pictures of water changing from a solid to a liquid to a gas or vice versa, tell if heat is being added or taken away.
3. When shown a picture of a child shopping in a grocery store, name at least 10 things he can see which are matter.
4. Given two balls, illustrate how the earth spins on its axis and how it moves around the sun.

GRADE 2

The pupil will -

1. Given a glass, five marbles, and a pan of water, demonstrate that air and marbles, examples of matter, take up space.
2. Given pictures of the sun, moon, a star, the earth, a light bulb, a mirror, and a neon sign, circle those objects that give off light and put a box around those that reflect light.
3. Given a globe and a flashlight, illustrate why the earth has day and night.
4. Using the globe, a flashlight and a ball, illustrate the way the moon moves around the earth.

GRADE 3

The pupil will -

1. Given a metric ruler, measure in centimeters and millimeters an object that is less than one meter long.
2. Given the mass of several objects in grams, pick out the one that weighs the most and the least.
3. Compare the sun and the earth with a star and the moon with the earth.
4. Given a map of the solar system, identify the Sun, Earth, Marsa, Venus and Saturn.
5. Describe two ways that the wind changes the land and the two ways that the water changes the land.
6. Given appropriate pictures of polluted environment, point out evidences of pollution and suggest some causes, effects and remedies of such pollution.

GRADE 4

The pupil will -

1. Given a compass, determine the north direction and then indicate south, east, and west.
2. When shown a picture of the sun's rays being focused by a lens on a piece of paper, describe what will happen and identify the kinds of energy involved.
3. When given a group of appropriate pictures, point out the evidences in those pictures that water vapor is in the air.
4. Compare fresh water with salt water and tell where each is found on the earth.
5. Draw a simple water cycle and describe how salt water of the ocean changes into fresh water of the river.
6. Describe the way that the weather changes during the four seasons of the year.
7. Given a thermometer, determine the temperature of three glasses of water and indicate the one which is the hottest.

GRADE 5

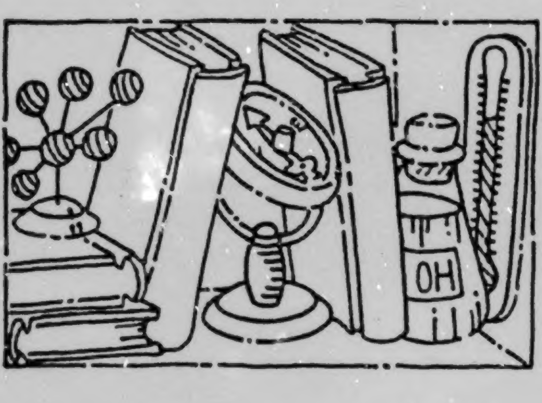
The pupil will -

1. Define matter, element, atom, compound, molecule, and mixture.
2. Given a list of common substances, identify the elements, the compounds, and the mixtures.
3. Given a prism, separate a beam of light into the spectrum of colors and then describe a rainbow in terms of this demonstration.
4. Define day, night, and year in terms of the movement of the earth around the sun.
5. Given a list of common rocks and minerals, given one use for each.
6. Given a diagram of the cross section of the earth, label the atmosphere, the biosphere, the crust, the mantle, and the core.
7. Make a pencil drawing showing what the ocean floor might look like between two continents.

GRADE 6

The pupil will -

1. Given a star map of the northern sky, point out the Big Dipper and Polaris, and the North Star.
2. Given a list of substances (including lakes, ice, oceans, rivers, clouds, dew, sleet, hail, snow, fog, and rain), indicate those which are water.
3. Name the two forces that would do the most damage if a hurricane moved over this area.



A NATURAL PARTNERSHIP FOR LEARNING

Development of students' reading skills in content areas, such as science, is one of the thrusts of the Right to Read effort in Texas.

Students aren't necessarily able to read science textbooks just because they can read basal readers, educators have found.

Science books are difficult for some to read because science has:

- a unique vocabulary to learn
- complex concepts to understand
- maps, graphs, charts, and calibrations on instruments to decipher

Furthermore, science books frequently are written at a level beyond the students' abilities both in reading and in science.

Many successful science teachers are accepting the responsibility of instructing students to read science materials. By enabling students to become better readers, science teachers can help them to become better science students.

SCIENCE: AN APPROPRIATE VEHICLE FOR DEVELOPING READING SKILLS

Science helps students learn:

- to observe
- to reason
- to think rationally
- to express themselves verbally

As students develop these skills, they will become better readers.

Students develop specific reading skills in the study of science because they are called on:

- to utilize word attack skills
- to develop comprehension
- to become self-directed in reading
- to learn to interpret what is read
- to read creatively

In hands-on science investigations students are motivated:

- to analyze what they read
- to use what they read
- to make judgements about what they read

BEST COPY AVAILABLE

Vocabulary

The language of science introduces to the student as many new words as does a foreign language. Students need help in learning:

- Words unique to science, such as
  - photosynthesis
  - friction
  - multicellular
  - fulcrum
- Common words that have a special meaning in science, such as
  - culture
  - normal
  - resistance
- Symbols and abbreviations used in science, such as
  - Ω
  - H_2O
  - $<$
  - $\leftrightarrows$
- New words from science, such as
  - television
  - astronaut
  - sputnik
  - transistor

Comprehension Skills

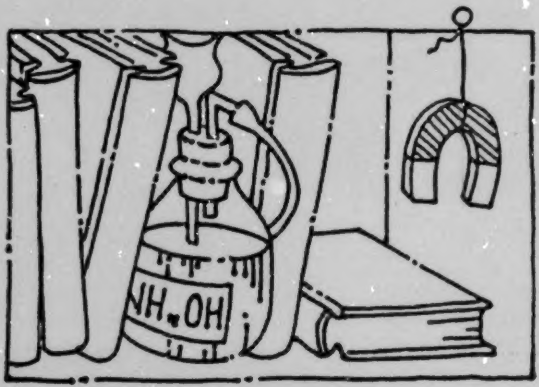
Science teachers can help students learn to:

- Recognize the main idea from graphs, charts, maps, and outlines
- Analyze information by
  - establishing a cause/effect relationship
  - synthesizing given "facts" into a viable idea
  - applying logic
- Formulate the central idea of a paragraph by
  - classifying, ordering, and sorting
  - observing similarities and differences

Speed

In science, students can develop the ability to adjust reading speed according to:

- Purpose
- Difficulty of material
- Complexity of concepts presented



AN EFFECTIVE METHOD OF READING SCIENCE MATERIALS

Teachers can further students' ability to read science materials by teaching them the following SQ3R* study skills formula:

1. Survey

Look over the science materials to be read.

Note:

- Title
- Headings
- Pictures, charts, graphs
- Special words

Give attention to:

- The first paragraph. Here the author usually gives the general scope of the topic covered.
- The last paragraph. This is the author's last chance to give "the message."

2. Question

Have a reason to read the materials. For each unit ask who?, what?, when?, where?, why?, and how?

3. Read

Answer the questions formulated. Read one section at a time.

Answer the questions on the section before going to the next section.

4. Recite

Recite aloud from memory the answers to the questions. Write them down.

5. Review

- Go over notes.
- Get the main idea.
- Recite the answer to all of the questions.
- Restudy the parts missed.

*Francis P. Robinson, *Effective Study: Revised Edition*, New York: Harper and Row, Publishers, 1961, pp. 13-14.

READING GRAPHS, CHARTS, MAPS, AND CALIBRATIONS

Special reading techniques are often required to understand the variety of sources which provides information for science students.

Graphs and Charts

Graphs and charts require reading from left to right and from bottom to top, top to bottom, and/or diagonally.

To read graphs and charts, students should:

- read the legend and interpret it in their own words
- note keys to the meanings of different colors, lines, and/or figures
- read labels at the bottom and left margins
- trace fluctuating lines and generalize on the kind of movement and what it means

Maps

The development of thinking skills used in problem solving is closely related to the development of the ability to read a map. In reading maps, students must:

- focus on what information is needed from the map
- observe the parts of the map that will provide the information needed
- analyze the information obtained from the map
- synthesize the information into a meaningful whole

Calibrations on Instruments

In reading calibrations, the students must ask:

- In what unit is the instrument calibrated? (Centimeters?, grams?, revolutions per minute?)
- Will the quantity measured be useful in providing appropriate information? (Centimeters will tell how long an item is, but not how heavy.)

By developing the special reading skills necessary for the study of science, students become better readers and better science students.

1978 GE8 841 01

Science Section
Division of Curriculum Development
Texas Education Agency
201 East 11th Street
Austin, Texas 78701

LEARNING PARTNERS: READING AND SCIENCE

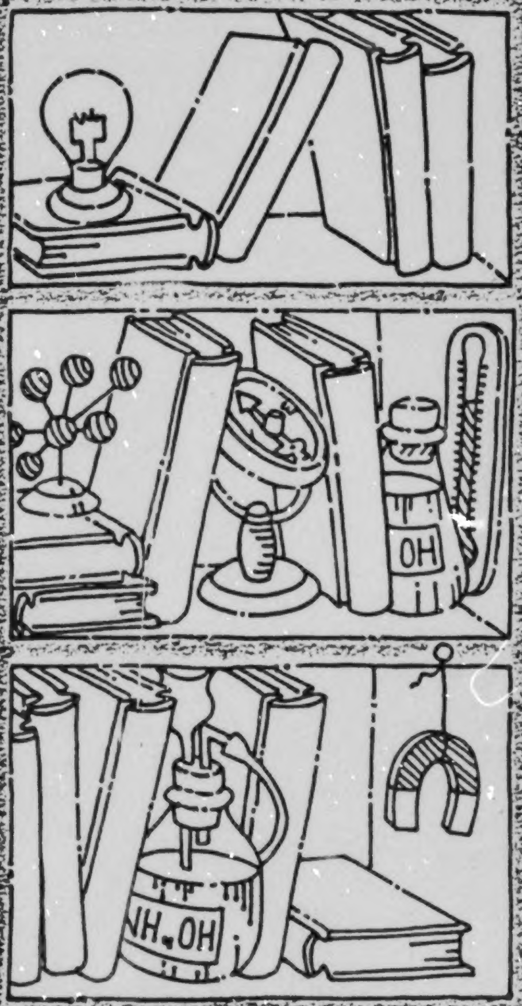


TABLE OF PREFIXES, SUFFIXES AND ROOTS

FREQUENTLY USED IN SCIENCE

A relatively small number of Greek roots and Latin roots are used in a large variety of ways in scientific vocabularies. A knowledge of these will enable one to translate most of the terms used in science subjects. A study of prefixes, suffixes and roots will help one to achieve an ability to derive meanings from context, which is important in both reading and understanding.

Prefix, Suffix or Root	Meaning	Example
a	negative, nor, without	asexual, amitosis
ad	to, toward	adductor, adrenal
alb	white	albino
amphi	both, double	amphibia
anthrop	human, man	anthropology
anti	against	antitoxin
aqua	water	aqueous
archeo	ancient	archeology
auto	self	automatic, autobiography
bar	weight, heaviness	barometer
bi	two	binary
bios	life	biology
brachi	arm	brachiopod
centr	center	centrifuge
cephal	head	cephalorhorax
chlor	green	chlorophyll
chond	cartilage	chondiosome
chrom	color	chromatic
coel	hollow	coelom
cyst	pocket, capsule	statocyst

Prefix, Suffix or Root	Meaning	Example
cyt	cell	cytology
dem	people	demographic
dendr	tree	dendrite
derm	skin	ectoderm
di	two, second	dihybrid
ect	outer	ectoderm
ef	away, outward	efferent
end	inner	endoderm
enter	intestine	enteric
epi	upon, above	epidermis
eu	well, true	eutheria
ex	from, outer	excertion, exoskeleton
fer	bear, carry	porifera
gaster	stomach	gastric
gene	birth, descent	genalogy
ge	earth	geography
glossa	tongue	hypoglossal
graph	write	geography
haem	blood	hemoglobin, hemotology
hetero	other, differenct	heterozygous
holo	entire, whole	holoblastic
homo	like, same	homology
hydr	water	hydrometer, hydrocephalic
hyper	over	hypertension
hypo	under, less	hyperdermic
iso	equal	isometric

Prefix, Suffix or Root	Meaning	Example
lamella	leaf or layer	lamellate
log (os)	study, discourse	biology, zoology
lun	moon	lunar
macro	large	macronucleus, macroscopic
maxilla	jan	maxilla, maxilliped
mer (os)	part, side	merozoite
meso	middle	mesoderm
meta	beyond, after	metazoa
meter	measure	thermometer
mito	thread	mitosis
morph	form	morphology
muta	change	mutation
myo	muscle	myofibril
nephro	kidney	nephridia
noto	dorsal	notochord
nym	name	pseudonym
oid	like	zoiid
omni	all, total	omnivorous
ortho	straight	orthoptera
osteo	bone	osteomyelitis
para	near, beside	parathyroid
peri	around	pericardium
phag	eat	phagocyte
phil	attraction	eosinophil
phob	fear	claustrophobia
phon	sound	phonograph
phor	bear, carry	mastogophora

Prefix, Suffix or Root	Meaning	Example
photo	light	photosynthesis
phyt	plant	epiphyte
plasma	mold, form of life	protoplasm
pleur	side	pleuron
ped	leg, stem	milliped
pod	leg, appendage	arthropod
proto	first	protozoa
pseudo	false	pseudopod
pter	wing	diptera
sarc	flesh	sarcoplasm
scien	knowledge	omniscient
scler	hard	sclerite
soma	body	somatic
stom	mouth	stomata
syn (m)	together	synapse, symbiosis
taxis	arrangement	taxonomy
tel	far, distant	telescope, telephase
theca	sheath	spermatotheca
therm	heat	thernoneter
throm	clot	thrombosis
tom	piece, section	anatomy
top	place	topography
tox	poison	toxic
trema	hole	trematod
troph	turn	toward
vagus	wandering	vagus nerve
zo (on)	animal	zoology
zyg	united, tied	zygote

Quantitative Prefixes

Prefix	Meaning	Example of Use
mon	one	monotone, monoxide
un	one	unicellular, unilateral
bi	two, twice, double	bicycle, bifurcate
di	two, twice, double	dimorphic
du	two, twice, double	duplex
ter	three	tertiary
tri	three	tripod, tritium
tetr	four	tetrachloride, tetrahedro
quadr	four	quadruped
a	without	abiotic
an	lacking	anarchy
heter	mixed	heterogeneous, heteromorp
hom	similar, throughout	monograft, homogenized mi
hyper	above, over, excessive	hyperesthesia, hypertoxic
hypo	less than, below, deficient	hypodermic, hypothyroid
is	equal, same	isomorphs, isothermal
micr	small	microscope, microbiology
poly	many, much	polychrome, polynuclear
tel	distant, far	telescope, television

From *The Language of Science* by Alan Mandell
National Science Teachers Assn., Publishers

LABORATORY INFORMATION

Laboratory Safety Precautions for Students

Touch or handle equipment only after instructions are given.

Keep lab tables clear of books, purses, microscope covers, etc., while doing investigations.

Stay in your assigned area during lab.

Use gas jets only for lab experiments with Bunsen burner.

Know where the fire extinguisher is located in the lab room. Never attempt to blow out a fire or pour water on a chemical fire.

Be careful when using scissors, forceps, and other sharp objects.

When indicated by the lab teacher, GOGGLES are to be worn.

Report any accident--cuts, burns, breakage of glass, etc., immediately to the teacher.

When working with microscopic specimens, wash hands thoroughly with soap and water at the end of the lab session.

Enter the preparation room only with permission from the teacher.

Care of the Lab and Equipment by Students

Pick up after yourselves! Throw paper trash in the waste can before leaving the lab room. Clean sinks and water cabinets.

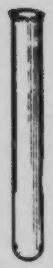
The brown paper towels are used for drying hands. The sponges are for wiping table tops and sink tops.

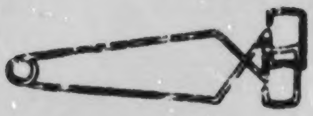
Leave the lab tables with clean equipment, chairs pushed in, and expendibles replaced.

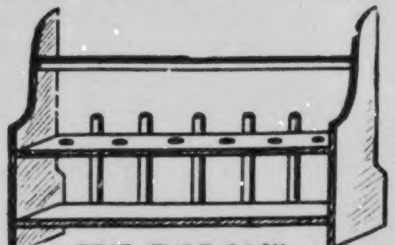
It is important that science equipment be kept in good, clean condition and stored in an orderly way.

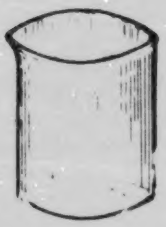
IN LAB: LISTEN, LOOK, LEARN

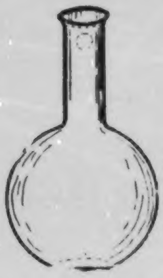
PICTURES OF LABORATORY EQUIPMENT

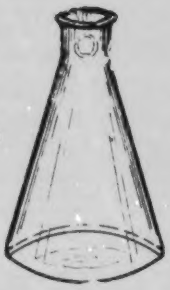

TEST TUBE

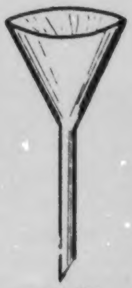

TEST TUBE HOLDER

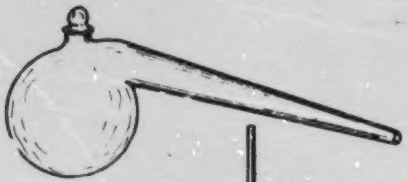

TEST TUBE RACK

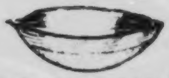

BEAKER

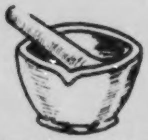

FLORENCE FLASK

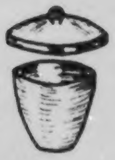

ERLENMEYER FLASK

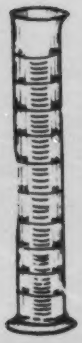

FUNNEL

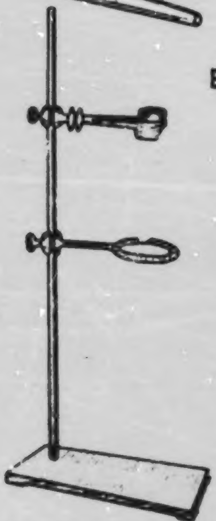

RETORT

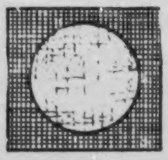

EVAPORATING DISH

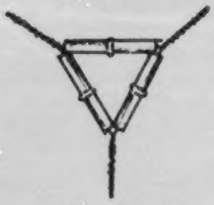

MORTAR AND PESTLE

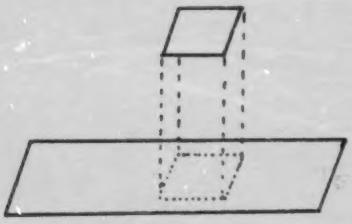

CRUCIBLE


GRADUATE

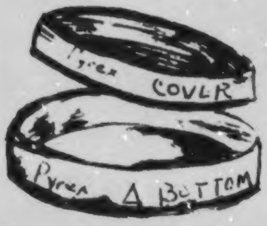

RINGSTAND WITH CLAMP AND RING


WIRE GAUZE WITH
ASBESTOS PAD

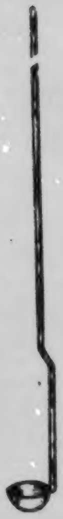

PIPE STEM
TRIANGLE

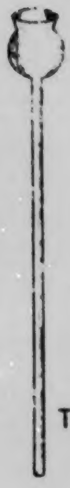

COVER SLIP

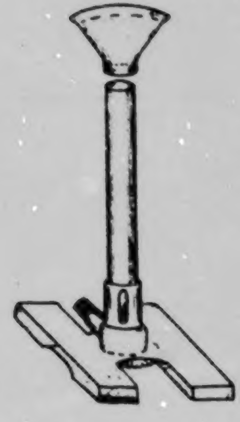
SLIDE

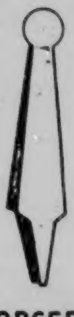


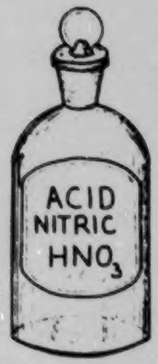
PETRI DISH

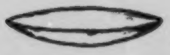

DEFLAGRATING SPOON

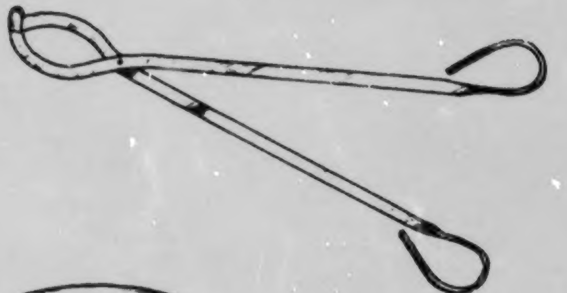

THISTLE TUBE


BUNSEN BURNER WITH WING TOP

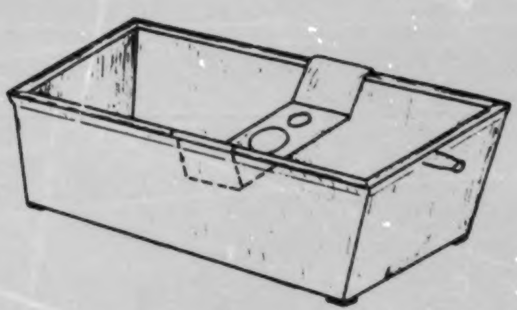

FORCEPS

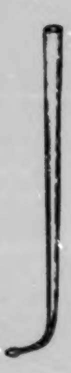



WATCH GLASS

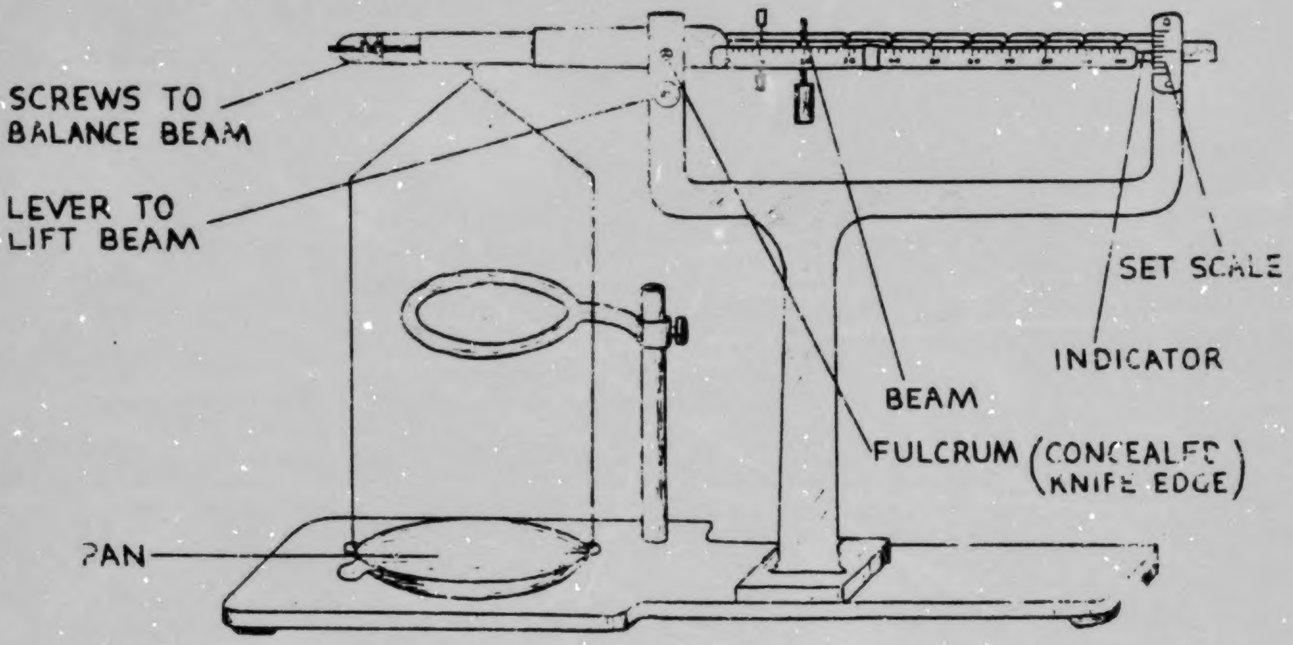

TONGS

REAGENT BOTTLE

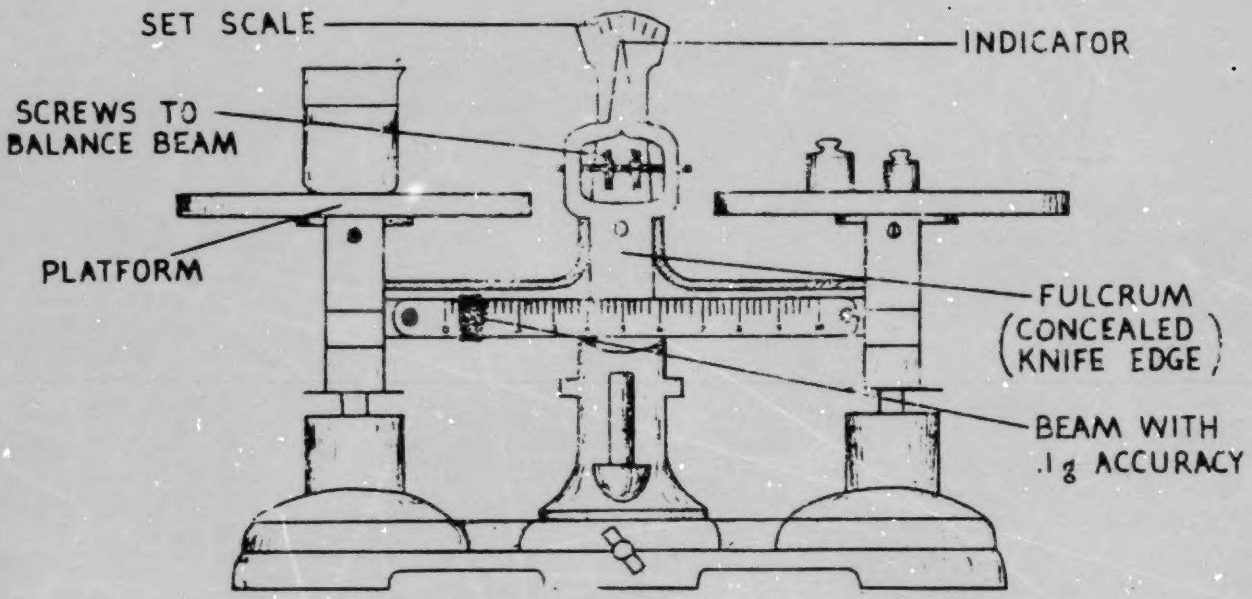

PNEUMATIC TROUGH


BLOWPIPE

COLLECTING BOTTLE


SCREWS TO BALANCE BEAM
LEVER TO LIFT BEAM
SET SCALE
INDICATOR
BEAM
FULCRUM (CONCEALED KNIFE EDGE)
PAN

TRIPLE BEAM BALANCE


SET SCALE
INDICATOR
SCREWS TO BALANCE BEAM
PLATFORM
FULCRUM (CONCEALED KNIFE EDGE)
BEAM WITH .1g ACCURACY

PLATFORM BALANCE

MATERIALS

Textbook

The textbook adopted for eighth grade Earth Science is *Focus on Earth Science*, Second Edition, published by Charles E. Merrill, a division of Bell and Howell Company. The authors are Margaret S. Bishop, Phyllis G. Lewis, and Richmond L. Bronaugh, Consultant. Teachers should also have the Teacher's Annotated Edition of the textbook *Earth Science Activity-Centered Program Teacher's Guide*, *Earth Science A Learning Strategy for the Laboratory*, Teacher's Annotated Edition, and *Earth and Space Science Skillcards*.

Supplementary Aids

Films: A list of movies suggested for use will be added to each outline. The library of each school in the District has a Science Film Catalog for the teachers' use. It is suggested that before the film is used, it should be previewed and used only if it is appropriate to the subject being taught. The time length for each film is also listed for the teachers' aid.

Filmstrips and Transparencies: Each school has its own filmstrips and transparencies, which are kept in the library. Teachers can be of great help to the librarian by suggesting filmstrips and transparencies which they would like to have in their building. Each school librarian has an approved lsit of filmstrips and transparencies from which to make selections.

Charts: Each school has its own supply of science charts. Additional charts may be ordered through the HISD Warehouse Catalog which the chairman should have. If none is available, contact the Science Department at the Administration Building.

Models: Each school should have its own models. Additional models may be ordered through your building's equipment fund. The Museum of Medical Science has a lending or checking out system of their models.

Science Materials for the "Hands-On" Activities in *Focus on Earth Science*

The following is a list of materials and equipment needed for students to complete the science activities suggested in Earth Science. These activities usually require little preparation and can be completed with easily obtained materials or simple laboratory equipment. The activities promote student involvement in exploring the concepts and processes of the earth sciences.

UNIT I

Earth Science

Chapter 1: Earth Science

(Suggested Time: 7 days - One Semester)
8 days - Two Semesters)

Major Concepts to be Taught

What earth science is
Some branches of earth science and their interrelations
The role of deductive reasoning in earth science
Use of the international system of measurement

Essential Learner Outcome

Given a list of objects and activities and a list of the four major earth sciences, indicate whether geology, oceanography, meteorology, or astronomy would be involved in the study of each object or activity.

Instructional Objectives

The student should be able to:

B . differentiate between a hypothesis and a theory
e . describe the various branches of science
e . explain the relationship of earth science to other branches of sciences
B . identify the steps of the scientific method used in solving problems
B . recognize units used in the SI system of measurement and calculate changes in SI units
B . define science
B . demonstrate the use of a metric ruler, pan balance, and a graduated cylinder to determine length, mass, and volume using SI units
. discuss the difference between hypothesis and scientific theory

Assessment

The student will

e . define earth science

e . define geology, astronomy, oceanography, meteorology

e . match the sciences of geology, astronomy, oceanography, and meterology with any four of the following studies:

heavenly bodies
tides
tornadoes
Grand Canyon
eclipses
cloud formation
locating oil deposits
beach formation

CAREERS AND SCIENTISTS

Library assignment on Careers: (1) prepare a paragraph (2) make a one-minute oral presentation.

1.. aerodynamics
2.. aerophysics engineer
3.. thermodynamics engineer
4.. aeronautical engineer
5.. civil engineering
6.. chemical engineering
7.. petroleum engineer
8.. metallurgy
9.. mineralogy
10. nuclear engineering
11. surveyors
12. geodetic surveyor
13. park-landscape architect
14. volcanologist
15. meteorologist
16. climatologist
17. weather observer
18. navigations
19. atronomer
20. astrophysicist
21. radio astronomer
22. archeology
23. mining
24. economic geology
25. paleontology
26. glaciologist
27. hydrologist
28. oceanographer
29. seismologist
30. tectonophysicist
31. photogeologist
32. weather forecaster
33. hydrographer

Library assignment on scientists and their fields: (1) prepare a paragraph (2) make a one-minute oral presentation.

ANCIENT SCIENCE:

1. Ptolemy-astronomy

15TH-16TH CENTURY:

2. Tycho Brahe-astronomy
3. Nicolaus Copernicus-astronomy

17TH CENTURY:

4. Sir Isaac Newton-astronomy
5. Galileo-astronomy
6. Johannes Kepler-astronomy

18TH CENTURY:

7. Edmund Halley-astronomy
8. Gabriel Daniel Fahrenheit-physics
9. Alessandro Volta-physics
10. James Hutton-earth science
11. Benjamin Franklin-technology

19TH CENTURY:

12. Sir John Frederick Herschel-astronomy
13. Edward Charles Pickering-astronomy
14. Michael Faraday-physics
15. Wm. Thompson Kelvin-physics
16. Andre Marie Ampere-physics
17. George Simon Ohm-physics
18. Robert Wilhelm Bunsen-chemistry
19. Baron Alexander von Humboldt-earth science
20. Alfred Bernhard Nobel-technology
21. Alexander Graham Bell-technology
22. Charles Goodyear-technology
23. George Westinghoust-technology

20TH CENTURY

24. Edward Emerson Barnard-astronomy
25. Edwin Powell Hubble-astronomy
26. Niels Bohr-physics
27. Albert Einstein-physics
28. Wolfgang Pauli-physics
29. Sydney Chapman-earth science
30. Arthur Holmes-earth science
31. Sir Harold Jeffreys-earth science
32. Auguste Piccard-earth science
33. Felix Andries Vening Meinesz-earth science
34. Alfred Lothar Wegener-earth science
35. Walter Maurice Elsasser-earth science
36. William Maurice Ewing-earth science
37. Yuri Gagarin-technology
38. Thomas Alva Edison-technology
39. Robert Hutchings Goddard-technology
40. Charles Lindbergh-technology
41. Wernher Von Braun-technology
42. Wilber and Orville Wright-technology
43. Jacques Cousteau-Oceanography

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	
Differentiate between a theory and a hypothesis.	* Have students read Section 1:2 (Modern Explanations), then discuss why a theory is more factual than a hypothesis.
e Describe various branches of science.	Have students prepare a paragraph and make a one-minute oral presentation on careers associated with earth science. (See "Careers and Scientists.") * Have students make a collection of pictures or drawings showing various scientific fields.
e Explain the relationship of earth science to other branches of science.	@ Have students do in-depth research into field of interest. Have students complete activity 1:2 on page 4 in Review and Reinforcement Guide. Invite a guest speaker from the community--meteorologist, geologist, aeronautical engineer, marine biologist, etc. Discuss the combining of various sciences such as astronomy and physics into astrophysics in order to study the energy and forces of matter in cosmic bodies.
B Identify the steps of the scientific method used in solving problems.	Have students do exercise 1:1, The Scientific Method on page 3 in the Review and Reinforcement Guide (Review Book). Discuss with students the need for scientists to organize their experimental data. Emphasize that graphs are a way to present data from which conclusions can be drawn, then have students use data to make a histogram and line graph. See pages 2-5 in Earth Science Activity-Centered Program (Activity Book).
B Recognize units used in the SI system of measurement and calculate changes in SI units.	Students may only need to be reviewed over the metric system since most of them studied the metric system in grade seven. Have students to complete activity 1.1 on page 14 in the text.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Students should keep records of their work which allows for easy reviewing and checking. See pages 11T-13T in lab manual, and xxx in the activity book for Suggestion on Evaluating Activity Work.
	Hand out copies of "Metric System Worksheet I," and have students complete this exercise.
	Hand out copies of "Metric System Worksheet II," and have students complete this exercise.
	* Students could do the "Student Worksheet on the Nifty Metric Ruler" found in this guide. Distribute copies to students.
	* Distribute copies of "Drawing: One Section of the Meter Stick" and have students complete this exercise.
	@ Students could do the activity "Metric Measurement Outdoors." Distribute copies to students and have them complete this activity.
	Have students do "Science 8-Lab Activity" in this guide. Hand out copies to students.
	* Distribute drawings of the triple beam balance and platform balance. Have students to observe both balances and describe the difference between them. If you have balances available let students examine them and describe their differences.
	@ Hand out copies of "The Laboratory Balance" and have students to read and compare similarities and differences of the balance. Also, have students explain and/or demonstrate how to weigh an object.
	Have students do Lab 2 - Measuring Using SI Units in Focus on Earth Science A Learning Strategy for the Laboratory (Lab Manual).
	* Hand out copies of "Thermometers" and have students complete this exercise.
	Students could do the "Graduated Cylinder Activity" in this guide.
	For additional information on the metric system, you could hand out copies of "Measurement System International" and "Metric Information."

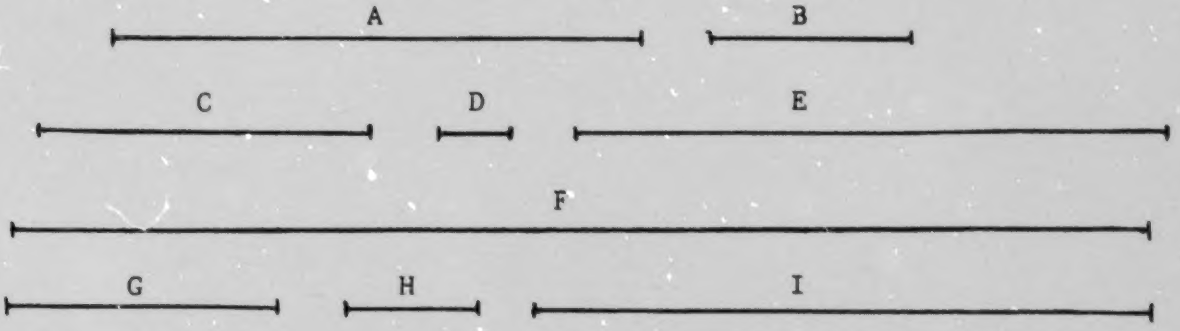
STUDENT WORKSHEET ON THE NIFTY METRIC RULER

THE WORKSHEET REQUIRES THE USE OF A STUDENT-SIZE 12-INCH METRIC ENGLISH RULER

Your Metric-English ruler has 2 SETS OF NUMERALS. The 1 to 12 set measures in INCHES (in.), and the 1 to 30 set measures in CENTIMETERS (cm.). Notice that each cm. contains 10 MILLIMETERS (mm.).

SOME THINGS TO DO WITH YOUR METRIC RULER:

1. Measure the LENGTH of this page to the nearest cm. ________cm.
2. Measure the WIDTH of this page to the nearest cm. ________cm.
3. Measure each of the following line segments to the nearest cm.



(a) ________cm. (b) ________cm. (c) ________cm.

(d) ________cm. (e) ________cm. (f) ________cm.

(g) ________cm. (h) ________cm. (i) ________cm.

4. Now measure each of the line segments in (3) above in mm.

(a) ________mm. (b) ________mm. (c) ________mm.

(d) ________mm. (e) ________mm. (f) ________mm.

(g) ________mm. (h) ________mm. (i) ________mm.

METRIC SYSTEM WORK SHEET I

Use your information sheet as a guide.

I. Fill in the chart

	Metric	English system
Length	________	________
Volume	________	________
Weight	________	________

II. Drill

A. Meters

1. $\frac{1}{1000}$ of a meter = ________
1 meter = ________ millimeters
2. $\frac{1}{100}$ of a meter = ________
1 meter = ________ centimeters
3. $\frac{1}{10}$ of a meter = ________
1 meter = ________ decimeters
4. 1 kilometer = ________ meter
1 meter = ________ kilometers

B. Liters

1. $\frac{1}{1000}$ of a liter = ________
1 liter = ________ milliliters
2. 1 kiloliter = ________ liters
1 liter = ________ kiloliters

C. Grams

1. $\frac{1}{1000}$ of a gram = ________
1 gram = ________ milligrams
2. $\frac{1}{100}$ of a gram = ________
1 gram = ________ centigrams
3. $\frac{1}{10}$ of a gram = ________
1 gram = ________ decigram
4. 1 kilogram = ________ grams
1 gram = ________ kilogram

III. Complete the following table. Write the words and abbreviation

		Length	Volume	Weight
	Unit Names	meter		
Prefix	milli $\left(\frac{1}{1000}\right)$	millimeter (mm)		
	centi $\left(\frac{1}{100}\right)$			
	deci $\left(\frac{1}{10}\right)$			
	kilo $\frac{\ }{1000}$			

IV. Work the following problems:

1. 2 kilometers = ______________ meters
2. 1 centimeter = ______________ meters
3. 1 milligram = ______________ grams
4. 2000 milliliters = __________ liters
5. 1 gram = ____________________ milligrams
6. 4,000 millimeters= __________ meters
7. 32 liters = _________________ milliliters

METRIC SYSTEM WORKSHEET II

Use your information sheet as a guide.

I. What unit of measurement in the metric system would you use to determine the following?

1. The size of a room?____________________
2. The amount of juice in a glass?____________________
3. The distance traveled from here to Conroe?__________
4. The amount of gasoline your parents' car uses per mile?____________________
5. The weight of a package of hamburger?____________________

II. A. Write the fraction and decimal value for each of the following prefixes.

	fraction	decimal
1. milli =	________	________
2. centi =	________	________
3. deci =	________	________

B. What is the value of the prefix kilo?____________________

III. Write out what each symbol respresents (Ex: dg - decigram)

1. m = ____________________
2. g = ____________________
3. cm = ____________________
4. mg = ____________________
5. km = ____________________
6. l = ____________________
7. ml = ____________________
8. kg = ____________________
9. mm = ____________________
10. dm = ____________________

IV. Work the following problems. List the types of measurement involved. (Ex: volume, distance, or mass)

		measurement
1. 4 km =	____________ m	____________
2. 600 cm =	____________ m	____________
3. 5 g =	____________ cg	____________
4. 2000 mm =	____________ m	____________
5. 5 kg =	____________ g	____________
6. 3 m =	____________ cm	____________
7. 3000 mg =	____________ cg	____________

8. 2,000 mg = ____________g ____________________

9. 2 l = ______________ml ____________________

10. 5,000 ml = ______________l ____________________

SCIENCE 8-LAB ACTIVITY
MEASUREMENT

Work in groups.

Each student make a copy.

I. *Goggle Box*
   A. Find the dimensions of the box in centimeters
      1. Length________cm
      2. Width________cm
      3. Height________cm

   B. Compute the volume of the box
      1. Volume=________cm
      2. Volume of water in ml it will hold is________ml

II. *Dimensions of Text Book*
   A. In Centimeters
      1. Length________cm
      2. Width________cm
      3. Height________cm

   B. In Millimeters
      1. Length______ mm
      2. Width________mm
      3. Height________mm

   C. Volume of water in ml it would hold if it were a prism. Volume=________ml

III. *Thickness of a Single Sheet of Notebook Paper* (Devise a method of doing this)
   A. Thickness is approximately________.

   B. Mass of a single sheet of notebook paper is________

IV. *Volume of Water Baby Food Jars Will Hold* (at room temperature)
   A. Large Jars
      ________ml

   B. Small Jars
      ________ml

V. *Temperature Measurement*
   A. Room Temperature
      F=________
      C=________

   B. Wet Temperature
      F=________
      C=________

Put a *wet* paper towel around the bulb and hold in front of fan until the temperature becomes constant. (remains the same)

METRIC MEASUREMENT OUTDOORS

STRATEGY:

You will perform all measurements in metric units.

You will make necessary calculations to convert metric units to English units.

MATERIALS:

Meter sticks

Pencil and paper

PROCEDURE:

Measure the length and width of a brick in the building, a parking space, football field, tennis court, gymnasium, car, and school campus.

Return to class and perform necessary calculations in order to complete chart.

Item measured		meters	kilometers	centimeters	millimeters	inches	feet	miles
Brick	(length)							
	(width)							
Parking space	(length)							
	(width)							
Football field	(length)							
	(width)							
Tennis court	(length)							
	(width)							
Gym	(length)							
	(width)							
Car	(length)							
	(width)							
Campus	(length)							
	(width)							

METRIC INFORMATION

Le Systeme International d' Unites (the International System of Units) has agreed to the following points for use of the metric system. (The SI you often run across as you read about the metric system refers to the International System of Units.)

1. Metre and litre are the favored spellings, rather than meter and liter.

2. In pronouncing the units, accent the prefix.

3. The symbols for tera, giga, and meta are capital letters. All other symbols are lower case letters.

4. The prefix and unit name are all one word: kilometer.

5. Use no period after the symbol unless it is the end of the sentence.

6. All symbols should use the singular form: 15 metres = 15 m (not 15 ms).

7. SI unit names are capitalized only at the beginning of sentences.

8. Separate the numerical value from the symbol by a space: 15 mm (not 15mm).

9. Use a space, (not a comma) to separate large numbers into groups of three: 1 234 769 (not 1,234,769).

10. Use decimal notations for the expression of partial units with zero before the decimal. Do not use fractions: 0.75 km (not 3/4 km).

11. A prefix should not be used alone: kilogram (not kilo).

12. The use of m^2 and m^3 is better than square metres and cubic metres.

13. "Mass" is preferred over "weight." Weight is a force and requires force units. Grams and kilograms measure "mass" while newtons measure "force." Use "What is the mass?" rather than "What is the weight?" if grams or kilograms are the units involved.

14. Record metric measurements as a single unit: 1.41 m or 141 cm (not 1 metre and 41 centimetres).

15. Capital "C" is the symbol for Celsius.

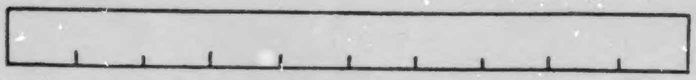
16. The symbol for "per" is a slash "/", as 30 km/h.

DRAWING: ONE SECTION OF THE METER STICK

BACKGROUND: The Metric System has the advantage of units based on tens and multiples of 10. For example, there are 10 millimeters in one centimeter; 10 centimeters in one decimeter; 10 decimeters in one meter; 100 centimeters in one meter; 1000 millimeters in one meter.

THUS, the Metric System is a decimal system.

ONE DECIMETER (dm)



PROCEDURE:

1. Label your drawing, "One Section of a Meter Stick."
2. Make a drawing of a part (section) of a meter stick, as shown above. Enlarge this smaller drawing, shown above, to a full page size drawing.
3. Use the following color code to color each part:

   (a) Millimeter: Blue
   (b) Centimeter: Red
   (c) Decimeter: Green

4. Label each part you have drawn. Be sure to use the correct symbol and color.
5. Draw a heavy black arrow along the bottom of your drawing to indicate the amount of length equivalent to one inch. (Hint: Remember you have enlarged the section of the meter stick that you have drawn.)

DON'T FORGET TO TITLE YOUR PAPER AND PUT YOUR NAME AND PERIOD NUMBER ON THE PAPER TO IDENTIFY IT. BE NEAT

THE LABORATORY BALANCE

Exact measurements are an important part of any science. Measurements of weight are of vital importance in chemistry. A chemical balance or scale has its accuracy built into it, but that accuracy can be seriously affected by the use and care that the balance receives.

Your instructor will designate some special place where weighings are to be made. *Never take your balance to your laboratory desk*; it is possible that it may come in contact there with caustic chemicals or water and thus start a corroding process which will destroy the accuracy of the balance. Avoid interchanging the parts of balances. *If you are to make several consecutive measurements, use the same balance each time*. Do not place hot objects upon the balance pan and never place any chemicals directly upon the pan. Return the balance to the scale cabinet when you finish working with it.

Examine your laboratory balance, noting the diagram. It will be either a triple beam or platform balance; the scientific principles of each are identical. An object to be weighed rests on a pan or platform and is to be balanced by weights on the opposite side of a fulcrum, or balance point. With the triple beam balance, weights are moved out along the bar from the zero point and into the position where the beam will be balanced. With the platform balance, small weights are placed on the platform until the beam is balanced.

Find the knife edge upon which the beam rests. If your balance has a beam release mechanism, locate the lever or screw which lifts the knife edge of the beam off the agate bearing. The balance should *never* be moved with the beam resting on the agate, and it is best to have the beam lifted whenever the balance is not in use.

Put all the weights at zero and see whether the beam is balanced. The center of the indicator on the beam should stop at the middle of the set scale or swing approximately equal distances on each side of the center. If it does not do so, ask your instructor to show you how to balance the beam.

To weigh an object, put that object on the left side of the balance; use a piece of paper or beaker as the container for chemicals. Add weight to the right side of the beam by moving the 10-gram weight out along the bar until that side of the beam dips, indicating that the weight on the left side has been exceeded. Move the weight back one notch and repeat the process on the 1 and .01 gram sections of the beam. The procedure would be the same with the platform balance, except that weights are taken from a box and placed on the right platform. These weights should be picked up with forceps, not with your hand. Add weights until a 10-gram weight causes the platform to dip. After removing the last 10-gram weight, use the slide on the single beam to complete the balance. The beam will be balanced when the weights plus the slide exactly match the weight of the object on the left side; the indicator on the beam will be at the center of the scale.

To read the weight when using the triple beam balance, take the sum of the weights on each bar of the beam. The .01 gram weight should be read on its left side. With the platform balance, take the total of the weights on the right platform plus the reading on the slide. Remember to subtract the weight of the container which held the chemical.

Use the lever to lift the beam off the knife edge. Remove the weighed object and return the weights to the zero position or to their storage box. Dust off any particles of chemicals, paper, etc., and return the balance to its cabinet.

THERMOMETERS

Name ____________________ Period ________________

Introduction to Thermometers:

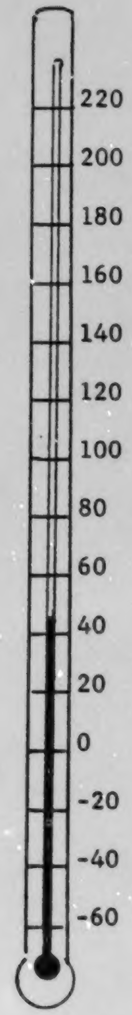
Thermometers are used to measure temperature. They are marked (calibrated) with a scale. There is a different scale for each of the termometers above. One is the scale in Fahrenheit degrees; the other is the scale in Celsius (or Centigrade) degrees.

In a Fahrenheit scale, each mark (division) is two degrees (2°). For example, 3 marks above 20° is 26°. In a Celsius scale each mark is only one degree, and three marks above 20° is 23°. Because we need accurate measurements this is very important.

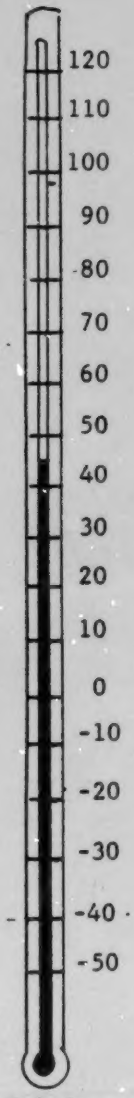
How to Read Thermometers:

Fahrenheit	Celsius
1. Find the point to be read. (Ex: arrow)	1. Find the point to be read. (Ex: arrow)
2. Read the first number below that point. (Ex: 40)	2. Read the first number below that point. (Ex: 40)
3. Count the number of marks from this number to the point to be read. (Ex: 3)	3. Count the number of marks from this number to the point to be read. (Ex: 3)
4. For each mark counted, add two degrees to the number below the mark. (Ex: 40° + 3 marks = 40° + 6° = 46°)	4. For each mark counted, add one degree to the number below the mark. (Ex: 40° + 3 marks = 40° + 3° = 43°)
5. This is the temperature.	5. This is the temperature.

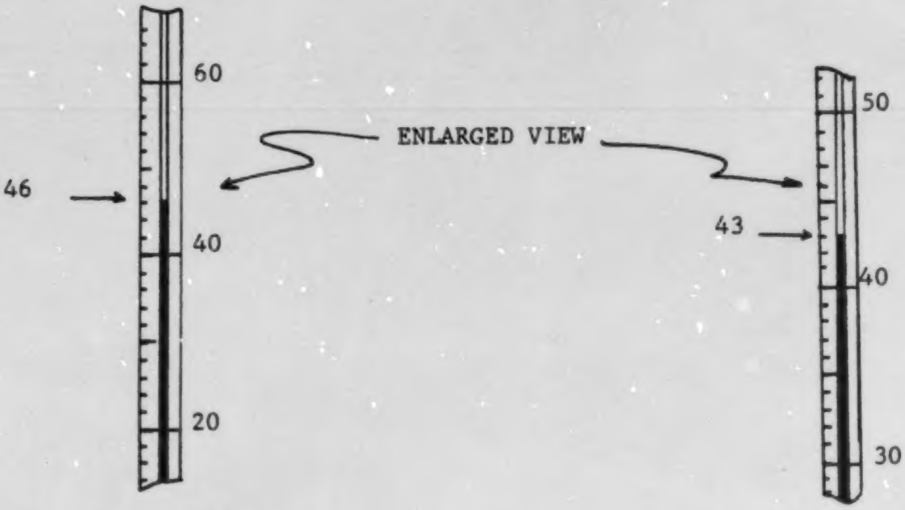
THERMOMETERS


220
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60

Fahrenheit


120
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50

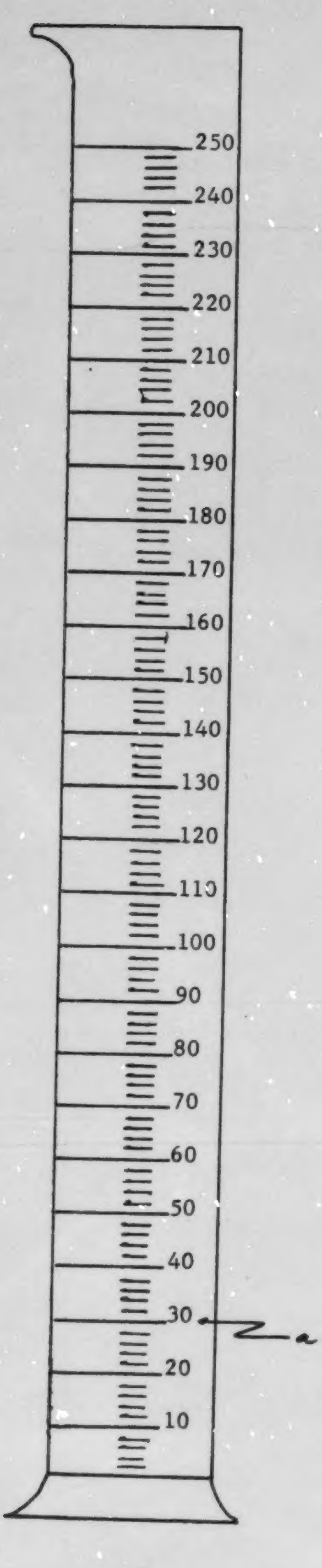
Celsius


60
ENLARGED VIEW
46
40
20
50
43
40
30

Fahrenheit

Celsius

GRADUATED CYLINDER ACTIVITY


250
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
a

1. Locate on the graduated cylinder at the left the following measures, and label them. (The first one is done for you.)

   a) 30 ml
   b) 230 ml
   c) 157 ml
   d) 119 ml
   e) 92 ml
   f) 24 ml
   g) 189 ml
   h) 114 ml
   i) 53 ml
   j) 225 ml
   k) 31 ml

One liter equals 1,000 cubic centimeters; therefore one milliliter is equal to one cubic centimeter.

2. Calculate the volume of the above measures, using the information about milliliters and centimeters to find it.

MEASUREMENT
System International

In this system of measurement, the unit of length is the meter, the unit of capacity or volume is the liter, and the unit of mass (often incorrectly called weight) is the gram.

In this decimal system of measurement, all sub-units vary by ten.

1000 units	100 units	10 units	Basic Units	.1 unit	.01 unit	.001 unit
kilo	(hecto)	(deka)	grams meter liter (dollar)	(deci)	centi	milli

The same prefixes are used with all the units. The prefixes in parenthesis are rarely used; you need to know that a sub-unit is there.

To change from one unit to another, move the decimal the number of spaces in the direction indicated by moving from the given sub-unit to the desired sub-unit in the chart above.

Examples: Change 15.72 dollars to cents.
Move the decimal two places to the right to get 1572 cents.
Change 456.7 kg to cg.
Move the decimal 5 places to the right to get 45,670,000 cg.
Change 667 ml to liters (l).
Move the decimal 3 places to the left to get .667 liters.

Some examples of sizes expressed in metric units are:

One meter is slightly longer than one yard.
A popsickle stick is one centimeter wide and slightly longer than one decimeter.
A standard paper clip is about one centimeter wide and the wire has a diameter of one millimeter.
A football field plus one end zone is about 100 meters.
Many students are familiar with two and three-meter diving boards.

A nickel has a mass of 5 grams and a paper clip about one gram.
A pound of butter has a mass of 454 grams.
A teaspoon of water has a mass of 5 grams.

A teaspoon will have a volume of 5 milliliters and a cup a volume of 240 milliliters.
A quart has a volume slightly larger than one liter.

For a student to calculate his own mass in grams, he would multiply his weight in pounds by 454 grams per pound. How would he change this mass to kilograms? Why are masses of people normally expressed in kilograms?

To find his height in centimeters, the student would multiply his height in inches by 2.54 centimeters per inch.

METRIC MEASUREMENT

Basic Units

Unit of Mass: Gram
Unit of Length: Meter
Unit of Volume: Liter

Decreasing- Increasing Metric Prefixes

Prefix	Multiple of Basic Unit
Kilo	1000
Hecto	100
Deka	10
Basic Unit	1
Deci	.1
Centi	.01
Milli	.001

The Metric System is used by scientists all over the world, and is used by everyone in many countries of the world.

I. Standard Metric units of measurement:

	symbol
A. Mass (weight) - grams	(g)
B. Volume - liters	(l)
C. Length - meters	(m)

II. Prefixes. These prefixes are commonly used for small or larger measurements.

A. Milli: $\frac{1}{1000}$ or .001

B. Deci: $\frac{1}{10}$ or .1

C. Centi: $\frac{1}{100}$ or .01

D. Kilo: = 1,000

III. Metric Unit of Length

A. Basic Unit: Meter

B. Centimeter (cm): $\frac{1}{100}$m; 1m = 100 cm

C. Decimeter (dm): $\frac{1}{10}$ m; 1m = 10 dm

D. Millimeter (mm): $\frac{1}{1000}$ m; 1m = 1,000 mm

E. Kilometer (km): 1,000 m; 1m = $\frac{1}{1000}$ km

IV. Metric Unit of Volume

A. Basic Unit: liter

B. Milliliter (used most often): $\frac{1}{1000}$ L; 1: = 1000 ml.

V. Metric unit of Mass (weight)

A. Basic unit: gram

B. Centigram $\frac{1}{100}$ g; 1g = 100 cg

C. Milligram $\frac{1}{1000}$ g; 1g = 1000 mg

D. Kilogram 1,000 g; 1g = $\frac{1}{1000}$ kg

VI. Metric English Equivalents

1 inch (in) = 2.54 centimeters (cm)
1 liter = 1.06 quarts (qt)
1 meter (m) = 39.37 inches (in)
1 mile (mi) = 1.61 kilometers (km)
1 kilogram (kg) = 2.2 pounds (lb)
1 pound (lb) = 454 grams (g)

Chapter 2: Views of Earth

(Suggested Time: 6 days - One Semester)
8 days - Two Semesters)

Major Concepts to be Taught

The use of models
The use of maps as models
How to interpret the dimensions of Earth from maps

Essential Learner Outcomes

Given a map of the Gulf of Mexico and the latitude and longitude of a hurricane at four different times, plot the movement of the hurricane during that period of time.

Instructional Objectives

The student should be able to:

- B . define and differentiate between the two types of models, physical and mental
- e . use lines of latitude and longitude to locate places on a map or globe
- B . use a scale and legend on a map
- . define topography and interpret a topographic map

Assessment Guidelines

The student will

- . explain the use of mental and physical models
- . explain the meaning of scale and legend on a map
- . determine the distance between two cities using the scale on a road map
- e . define longitude and latitude
- e . locate on a map longitude lines and latitude lines
- e . locate on a map: 0° latitude; 0° longitude; 180° longitude and their correct names
- e . use a map to give the correct location for Houston, Hawaii, Paris, and Buenos Aires
- . explain why we use latitude and longitude lines
- . define contour line, elevation, and contour interval

- make a contour map of a hill and a depression
- given a topography map, identify and label land features using symbols

Materials

Textbook: Focus on Earth Science, pages 23-41
Reference: Teacher's Edition, pages 39T to 42T

Lab Manual: "Earth Science-A Learning Strategy for the Laboratory"
No. 4-Comparing Maps
No. 8-Determining Latitude

Earth Science Activity-Centered Program, Teacher's Guide
Page 8 - Extension activity
Page 10 - Extension activity
Page 12 - Extension activity or identifying stream channels

Additional Suggestions:

- A, B, C, pages 39-41
- Points to Remember, page 39
- Words to Use, page 39
- How and Why, page 41
- More Ideas to Explore, page 41

Focus on Earth Science Review and Reinforcement Guide:

Page 9 - 211 Models
Page 10 - 212 Map of Geologists Walk
Page 12 - 2:3 Making a Hill from a Topography Map
Page 15 - 2:4 Interpreting Topographic Maps
Page 17 - 2:5 The World Map

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	
B Define and differentiate between the two types of models, physical and mental.	* Refer students to Figure 2-3 on page 25 and Figure 2-4 on page 26, have students to observe these pictures, then explain and discuss the difference between physical and mental models. Have students answer the Making Sure questions 2-5 on page 27. Have students do exercise 2:1 models on page 9 in the Review Book. Some students may have various models at home. Ask students to bring models to class and explain and/or illustrate how they put their models together. Have students compare these with the actual object. @ Have students make models of ships, airplanes, etc. and determine the scale between the model and the real object.
E Use lines of latitude and longitude to locate places on a map or globe.	Refer the students to the drawings, Figure 2-5 on page 29. From this they should understand that latitudes are measured north and south of the equator and that longitude lines are measured east and west of the prime meridian. E Give students individual maps of the world. Have them locate: 0° longitude, 180° longitude and give them the respective names. E Using the maps, globes, or atlas, call out the longitude of a location and have them give the name of the place. Or, you give the name and students give coordinates. Hand out copies of "Locating Places on the Globe" for this activity. Give students individual maps of the United States, (hand out copies of "Locating Places in the United States"), have students use longitude and latitude to find cities of the United States. E Give students a map of the Gulf of Mexico, and the longitude and latitude of a hurricane, and have them plot the movement of the hurricane. Many grocery stores have bags with hurricane tracking charts of the Gulf of Mexico printed on them.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	For additional hurricane information and tracking charts, write to: U.S. Government Printing Office National Oceanic and Atmospheric Administration Washington, D.C. 20402 or Hurricane Awareness Box 13407 Austin, Texas 78711
	Have students compare map projections by completing Lab No. 4 - Comparing Maps on pages 9-12 in Lab Manual. @ Have students with strong interest in mathematics to explore in detail the methods used to make map projections. Have students do Lab No. 8 - Determining Latitude. * Students could do Activity 2:5 on page 17 of Review Guide.
B Use a scale and a legend on a map.	The ability to use maps is an important skill necessary for the student to gain a practical appreciation of the characteristics and origins of the familiar features of the earth's surface. Therefore, it is desirable to display as many of different types of maps as possible. Have students to use reference material in the library to look up the history of map making from the time of the Babylonians to the present. Have students do Activity 2-1 on page 32. In this activity the students will use a map to determine the distance between two cities. This would be a good chapter to do interdisciplinary lessons with the social studies and mathematics departments. @ Using graph paper have students determine the area of a national park and a lake. These areas are generally outline on a state map.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Have students locate cities by coordinates.
	Have students use a map legend to identify major highways, airports, roadside rest areas, and other cultural features.
	Have students map a geologist's walk. This activity will help develop such skills as measuring, problem solving, and calculating. See page 10 of the Review Guide.
	Have students draw a detailed map of their neighborhood. Have them include a scale and legend.
Define topography and interpret a topographic map.	Obtain a topographic map of the United States by writing to the U.S. Government Printing Office, Washington, D.C. 20402, for the pamphlet "Landforms of the United States (30 cents).
	Contact the Houston Geological Society for information on how to obtain a topographic map of Texas.
	Plan a field trip to allow students to observe actual topographic features of Texas. You could plan a field trip to San Marcos, New Braunfels, Llano, and other places in Texas, with interesting topographic features. This field trip could also include a study of rocks and minerals, erosion by runoff water, groundwater, and groundwater deposits.
	Have students carry their cameras on the trip so they may take pictures of various landscape. You should plan a field trip at least one month in advance. The more time you allow for planning, the more organized the learning experience will be for the students.
	* Have students recognize various features on the map in figure 2-13 on page 34.
	Have students make a contour map of a hill and a depression by doing Activity 2:3 on page 12-13 of the Review Book. In this activity students will learn to make a hill from a topographic map.
	Familiarize students with the five rules used in studying contour lines.
	Have students do Activity 2-3 on page 37. In this activity students will make a contour map of a landscape.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Have students bring in photographs that show some different landscape areas where they have visited, locate these places on a map, and identify the topography. Students could do Activity 2:4 in the Review Guide on pages 15-16. Students will interpret topographic maps in this activity. Have students read Focus on Frontiers, "Landstat: Portraits of Earth" on page 38 of text. Have students identify the major features on each photograph. You can obtain other landstat photographs by writing to the National Aeronautics and Space Administration (NASA), Lyndon B. Johnson Space Center, Houston, Texas 77058, and ask for NASA Facts Pamphlet.

SCALE 8: Auld Lang Syne — It's Almost Farewell Time.

Locate the following, by latitude and longitude, to within one degree.

	Latitude	Longitude
1. Houston	30° N	95° W
2. Key West	24.5 or 25° N	82° W
3. Hatteras	35° N	76° W
4. San Juan	18.5 or 19° N	66° W
5. Vera Cruz	19° N	96.5° or 96 W
6. Miami	26° N	80° W
7. Port au Prince	18.5 or 19° N	73.5 or 74° W
8. Nassau	25° N	77° W
9. Camaguey	22° N	77° W
10. Apalachicola	30° N	85° W
11. Kingston	18° N	77° W
12. Isle of Pine's	22° N	83° W
13. Windward Islands	(Latitude only) 14° N	

14. Suppose a hurricane moved across the Yucatan Peninsula entering at 18° N. Lat. — 88° W. Long. and exiting at approximately 21° N. Lat. — 90° W. Long. It would travel about __300__ miles overland.

SCALE 8: Auld Lang Syne — It's Almost Farewell Time.

Locate the following, by latitude and longitude, to within one degree.

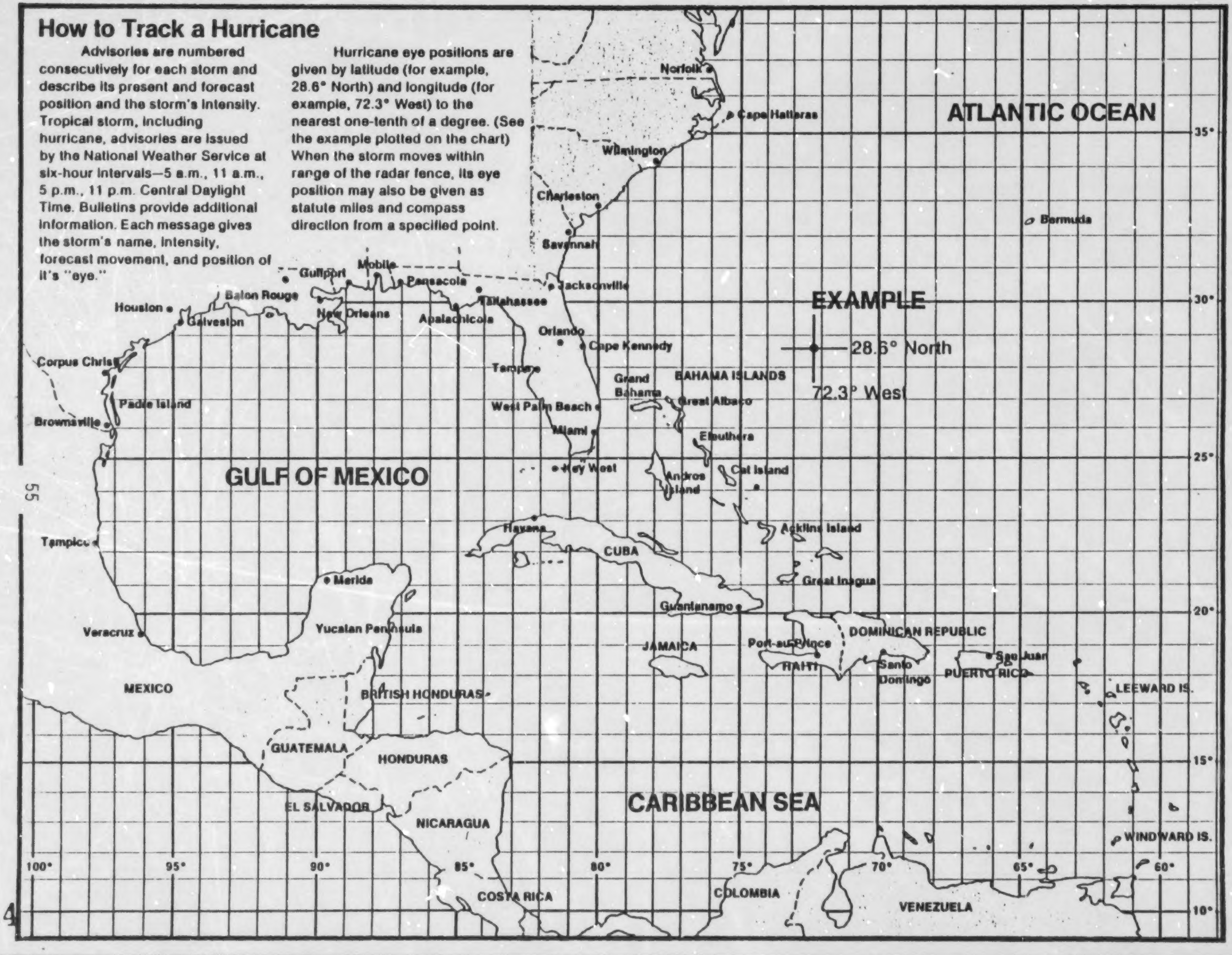
	Latitude	Longitude
1. Houston		
2. Key West		
3. Hatteras		
4. San Juan		
5. Vera Cruz		
6. Miami		
7. Port au Prince		
8. Nassau		
9. Camaguey		
10. Apalachacola		
11. Kingston		
12. Isle of Pine's		
13. Windward Islands	(Latitude only)	

14. Suppose a hurricane moved across the Yucatan Peninsula entering at 18° N. Lat. — 88° W. Long. and exiting at approximately 21° N. Lat. — 90° W. Long. It would travel about __________ miles overland.

How to Track a Hurricane

Advisories are numbered consecutively for each storm and describe its present and forecast position and the storm's intensity. Tropical storm, including hurricane, advisories are issued by the National Weather Service at six-hour intervals—5 a.m., 11 a.m., 5 p.m., 11 p.m. Central Daylight Time. Bulletins provide additional information. Each message gives the storm's name, intensity, forecast movement, and position of it's "eye."

Hurricane eye positions are given by latitude (for example, 28.6° North) and longitude (for example, 72.3° West) to the nearest one-tenth of a degree. (See the example plotted on the chart) When the storm moves within range of the radar fence, its eye position may also be given as statute miles and compass direction from a specified point.


Norfolk
Cape Hatteras
ATLANTIC OCEAN
35°
Wilmington
Charleston
Savannah
Bermuda
Mobile
Gulfport
Pensacola
Jacksonville
Baton Rouge
Houston
Galveston
New Orleans
Tallahassee
Apalachicola
EXAMPLE
30°
28.6° North
72.3° West
Orlando
Cape Kennedy
Corpus Christi
Tampa
Grand Bahama
BAHAMA ISLANDS
Great Albaco
Padre Island
West Palm Beach
Brownsville
Miami
Eleuthera
Key West
Cat Island
Andros Island
GULF OF MEXICO
25°
Havana
Acklins Island
Tampico
CUBA
Great Inagua
Merida
Guantanamo
20°
Veracruz
Yucatan Peninsula
DOMINICAN REPUBLIC
JAMAICA
Port-au-Prince
HAITI
Santo Domingo
San Juan
PUERTO RICO
MEXICO
LEEWARD IS.
BRITISH HONDURAS
GUATEMALA
HONDURAS
15°
CARIBBEAN SEA
EL SALVADOR
NICARAGUA
WINDWARD IS.
100°
95°
90°
85°
80°
75°
70°
65°
60°
COSTA RICA
COLOMBIA
VENEZUELA
10°

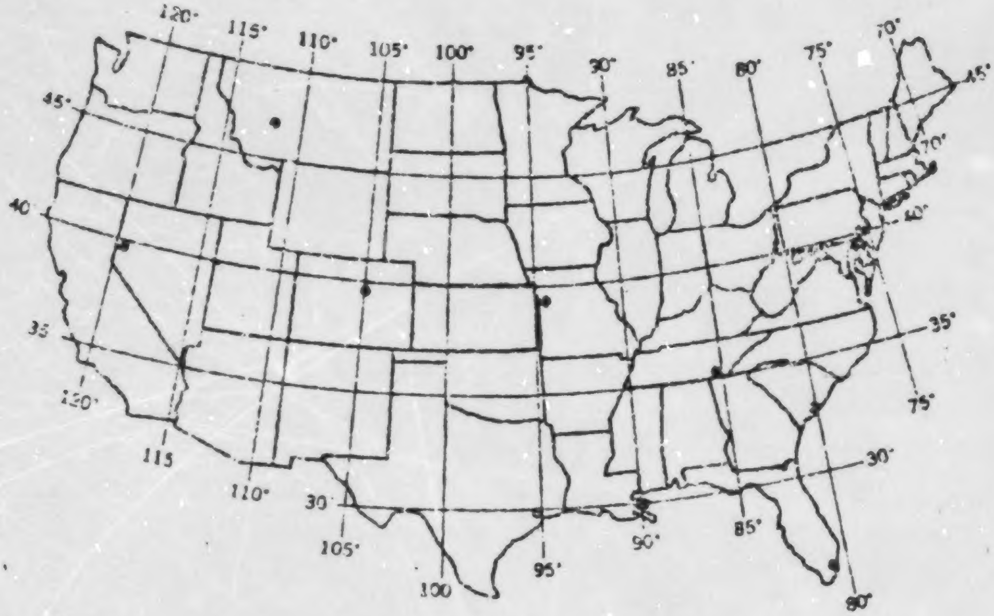
55

BEST COPY AVAILABLE

Locating Places in the United States

Below is a map of the United States, with ten black dots. Each dot stands for a city.

There is a list of those cities. Their latitude and longitude is listed after each one. Using latitude and longitude, find each city. When you have found it, label it with your pencil.


120°
115°
110°
105°
100°
95°
90°
85°
80°
75°
70°
45°
40°
35°
30°
45°
70°
40°
35°
75°
30°
120°
115
110°
30
105°
100
95°
90°
85°
80°

Charleston, South Carolina	33° latitude	80° longitude
Chattanooga, Tennessee	36° latitude	85° longitude
Denver, Colorado	40° latitude	105° longitude
Helena, Montana	47° latitude	112° longitude
Houston, Texas	30° latitude	95° longitude
Kansas City, Missouri	39° latitude	95° longitude
Miami, Florida	26° latitude	81° longitude
New Orleans, Louisiana	30° latitude	90° longitude
Philadelphia, Pennsylvania	40° latitude	75° longitude
Reno, Nevada	40° latitude	120° longitude

NAME________________________________ DATE________________________________

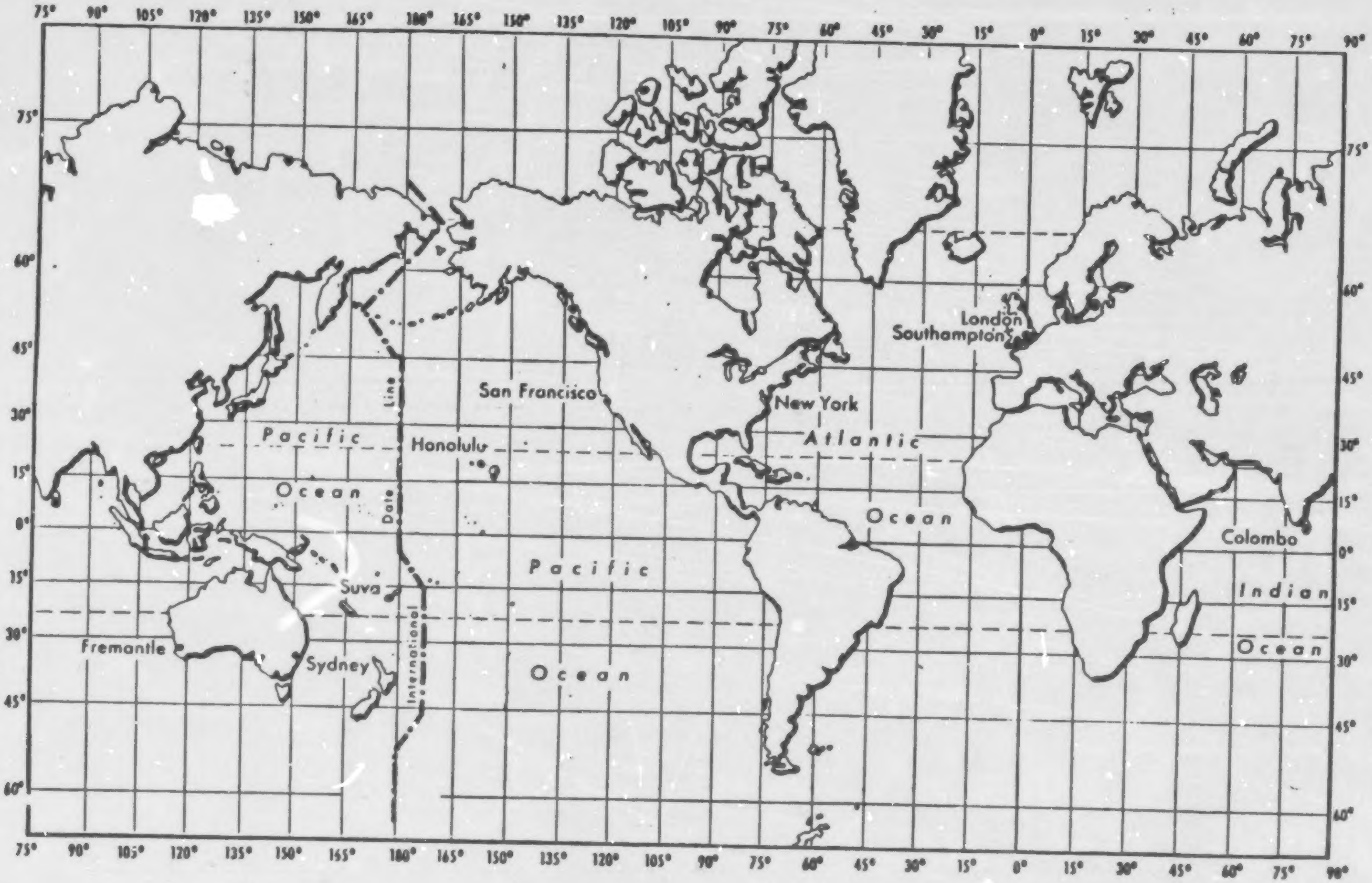
LOCATING PLACES ON THE GLOBE

I. Using the globe, atlas, or map, name the large cities located at the following latitude and longitude coordinates. (Latitude first.)

	Latitude	Longitude	City
1.	40°N	74°W	____________
2.	42°N	88°w	____________
3.	51°N	0	____________
4.	21°N	114°E	____________
5.	35°N	95°W	____________
6.	30°N	95°W	____________
7.	40°N	105°W	____________
8.	30°N	31°E	____________
9.	35°N	85°W	____________
10.	40°N	120°W	____________

II. Locate and give the coordinates (latitude first, longitude second) to the closest parallel line and longitude line, for the following cities.

	Cities	Latitude	Longitude
11.	San Francisco	________	________
12.	Sydney, Australia	________	________
13.	Madrid, Spain	________	________
14.	Tokyo, Japan	________	________
15.	El Paso, Texas	________	________
16.	Houston, Texas	________	________
17.	Kansas City, Mo.	________	________
18.	New Orleans, La.	________	________
19.	Miami, Fla.	________	________
20.	Mexico City, Mexico	________	________


75° 90° 105° 120° 135° 150° 165° 180° 165° 150° 135° 120° 105° 90° 75° 60° 45° 30° 15° 0° 15° 30° 45° 60° 75° 90°
75°
60°
45°
30°
15°
0°
15°
30°
45°
60°
London
Southampton
San Francisco
New York
Honolulu
Pacific
Ocean
Atlantic
Ocean
Pacific
Ocean
Indian
Ocean
Colombo
Suva
Fremantle
Sydney
International
Date
Line

BEST COPY AVAILABLE

CHAPTER 3: EARTH-MOON SYSTEM

(Suggested Time: 6 days - One Semester)
8 days - Two Semesters)

Major Concepts to be Taught

Theory of the origin of the solar system
The relationship between movements of bodies in space and gravitation
The effect of inertia, gravitation, and variation in speed causes elliptical orbits
The earth has several motions
How we know the earth is an oblate spheroid, and the use of reference points to determine location and time
Determination of the earth's density and specific gravity
The physical properties and motions of the moon
The interrelationships between the earth and moon

Essential Learner Outcomes

- Using a ball, demonstrate and/or explain the action of gravity and describe what would happen if there was no force of gravity on the earth.
- Given a list of the time zones or a map for the United States, place Houston, New York City, Los Angeles, and Denver in the proper time zone.
- Given the statement, "The portion of the moon we can see is that portion in the sunlight." Use a globe, flashlight, and a ball, or illustrations to explain the phases of the moon.
- List at least two conditions that exist on planet Earth that enables life as we know it to exist.

Instructional Objectives

The student should be able to:

. explain the theoretical origin or the solar system
e . explain Newton's laws of motion and apply them to daily use
. substitute in the formula for Newton's law of motion
e . demonstrate revolution and rotation as they apply to the earth and the planets, and the occurrence of days, years, and seaasons
B . demonstrate how planets move around the sun and describe the shape of their orbital paths
. explain why the earth is shaped as it is
. explain the method used to determine the earth's size
. compare the terms mass, weight, density, and specific gravity in reference to the earth
. distinguish between the crust, mantle, outer core, and inner core of the earth

e . use the time zones to tell time
e . identify the phases of the moon and show position of earth, moon, and sun for each phase
B . draw and explain a solar and lunar eclipse and understand why it is not a common occurrence
B . describe the properties of the moon and compare these to the properties of the earth and sun
. explain the theoretical origin of the moon

Assessment Guidelines

The student will:

. describe the dust-cloud theory
e . define gravity
e . discuss how mass effects gravitational attraction
e . use a tennis ball to explain gravity
. explain the difference between revolution and rotation
. use objects in the room to show how the earth revolves in relationship with the sun
. name and demonstrate the action that gives us day and night
. name and demonstratre the action that gives us a year
. use a globe to show the approximate inclination of the earth's axis
. draw the approximate shape of the orbits of the planets
. list common examples that prove the earth the earth is a sphere
. when given a drawing of a circle with imaginary axis and equator, reshape it to show the bulges and flattening of the earth
. give the name for the true shape of the earth
. define longitude and latitude
. locate on a map longitude lines and latitude lines
. locate on a map: 0° latitude; 0° longitude; and their correct names
. use a map to give the current location for Houston, Hawaii, Paris, and Buenos Aires
. explain why we use latitude and longitude lines
e . name the four time zones of the United States and locate their approximate position on the map
e . name the time zone for Houston, Texas
e . give the correct time for New York City, San Francisco, and Tuscon, Arizona, if it is 8:00 A.M. in Houston, Texas
. compare the difference between mass and weight
. describe orally or in writing the word density
. define specific gravity
. when given a drawing of the cross section of the earth, label all four major structural sections and describe them briefly
. name the eclipse that occurs when the moon is directly between the moon and the sun.
. name the eclipse that occurs when the earth is directly between the moon and the sun.
. label drawings of the eclipse.
. name the outer atmosphere of the sun that is seen naturally only during a total solar eclipse.

e . draw an example of these phases of the moon: full, quarter, crescent, gibbous.
e . use the drawing, figure 23-2 on page 471, without the labeling to illustrate the phases of the moon with regard to the position of the sun and moon.
e . explain where the moon gets its light source.
. describe some surface features of the moon.
. identify from a picture of the moon, craters, rays, and mountain ranges

Materials

Textbook: Focus on Earth Science, pages 42-61
Reference: Teacher's Edition, pages 42T-46T

Earth Science Skillcards:

No. 11 - The Moon--Dimensions
No. 12 - The Moon--Dimensions
No. 13 - The Moon--Direction of Orbit
No. 14 - The Moon--Craters
No. 15 - The Moon--Shock Lithification
No. 16 - Earth in Space--Barycenter
No. 31 - Earth's Crust - Density of Layers

Lab Manual: "Earth Science--A Learning Strategy for the Laboratory"
No. 5 - Earth's Spin
No. 6 - Moon Phases
No. 7 - Newton's First Law of Motion
No. 9 - Time Zones
No. 10 - Density and Bouyancy

Earth Science Activity-Centered Program, Teacher's Guide
Extension Activity - page 12
Extension Activity - page 13
Teacher Demonstration - page 13
Extension Activity - page 15

Additional Suggestions:
- A, B, C, pages 59-61
- Points to Remember, page 59
- Words to Use, page 59
- How and Why, page 61
- More Ideas to Explore, page 61
- Focus on Frontiers, page 58
- Readings to Discover, page 61
- Drawing of eclipse and phases of the moon
- Make a model of lunar landscape

Astronomy Guide:

- Ten Discoveries About the Moon, page 60
- How Are the Moon and Earth Similar, page 61
- In What Ways Are the Earth and Moon Different?, page 62
- Moon Phases, pages 67-68
- Solar Eclipse, page 75
- Evolution of the Moon, pages 62-64
- Lunar Features, pages 70-73
- How to Measure the Velocity of the Moon, An Airplane, or Superman For Fun and Profit
- The Distance to the Moon by Radar
- The Velocity of the Moon

Focus on Earth Science Review and Reinforcement Guide

Exercise 3:1	Origin of the Solar System and Earth - page 19
Exercise 3:2	Earth and It's Moon - page 20
Exercise 3:3	Motions of Earth and its Moon - page 21
Exercise 3:4	Moon Phases - page 22

Films:

5410 - Sun, Earth, and Moon (1968) 11 min.
L5202 - Target: Moon (1970) 24 min.
M5280 - Space Science: Exploring the Moon (1969) 16 min.
M3358 - Eclipses of the Sun and Moon

NASA Films:

HQ 230 - The Moon: An Emerging Planet - 15 min.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Explain the theoretical origin of the solar system.	Obtain information on the explanations of early man on such things as earthquakes, change of seasons, volcanic eruptions, day and night. (Library Investigation)
	@ Have a debate on the theories of the origin of the solar system. (Library Investigation)
	* Have students make a poster or model and explain the dust-cloud theory. They may use simple materials such as: styrofoam, cotton, glue, glitter, etc.
	Have students do exercise 3:1 Origin of the Solar System in the Review Book on page 19.
	Hand out copies of the lab activity, "Formation of Planets," and have students to complete this activity.
	Hand out copies of the lab activity "Collision and Temperature" and have students to complete this activity.
e Explain Newton's Laws of Motion and apply them to daily use.	Define: acceleration, velocity, mass, inertia.
	Have students use toy cars to demonstrate acceleration and velocity. Students can push cars from Point A to Point B, use a stop watch to determine how long it takes a car to go from Point A to B, measure the distance, then calculate the velocity of the car.
	Acceleration can be demonstrated by determining the speed of the car at intervals between Point A and B. START this part of the activity on a flat plane, then gradually incline the plane and let students calculate the acceleration of the car.
	Ask students to make believe they were going to push a car by themselves. Discuss how difficult it would be to move that car from its resting position. Next, have students make believe the opposite of this, the car is moving slowly towards them on smooth road. The engine has been cut off. Discuss how difficult it would be to stop the rolling car. Explain that both the car at rest and the car in motion has something to do with inertia.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Have students complete this activity: Activity: Materials--penny and glass. Place a penny in the glass. Hold the glass in your hand in a horizontal position. Point the open end of the glass forward. Be sure the penny remains near the bottom of the glass. Walk as fast as you can. Stop suddenly. What happens to the glass? Discussion: Did the glass stop moving when you stopped? Can you explain the actions of both the glass and the penny? Hand out copies of "Gravity" to each student. Go outside and throw a ball up as far as possible. Ask students to explain what would happen to the ball if there was no gravity. Have students complete the experiment on pages 17-18 in the Lab Manual, Lab Manual No. 7, Newton's First Law of Motion.
Substitute in the formula for Newton's Law of Gravitation $F::\frac{Mxm}{d^2}$	Throw the ball horizontally and notice the path. Hand out copies of "Mass, Gravity, Inertia," and demonstrate the relationship between gravitational attraction, mass and distance. Have the students act out daily happenings that explain Newton's three laws. (Example: letting air out of a balloon, pushing a cart, walking, rolling a marble across a table, etc.) Each action must be identified with an individual law. A good resource book for ideas is TEACHING SCIENCE WITH EVERYDAY THINGS by Victor E. Schmidt and Verne R. Rockcastle. (Addison-Wesley Publishers)
Demonstrate revolution and rotation as they apply to the earth and the planets, and the occurance of days, years and seasons.	Ask for a student volunteer. Have student demonstrate rotation and revolution by walking and/or spinning around a chair or another object in the classroom.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	
Explain why the earth is shaped as it is.	Hand out "Terminology: Forms and Layers of the Earth" and have students complete it. Demonstrate how ancient scientists used clues, such as the shape of shadows to piece together information about the shape of the earth. Darken the room except for a projector or other strong light source. Hold various shaped objects such as a disc, globe, a football, cube, square, etc., in front of the light so they cast a shadow on the wall (do these one at a time). Have the students try to guess the shape of each object by the shadow it casts. Use a globe and a small toy ship and simulate on the screen how ancient scientists observe the "disappearance and the appearance of a ship over the horizon," as another clue about the shape of the earth. Have students do lab No. 4--You're Spinning. A globe on a stand or sitting on a table will do just as well as a large ball. If students cannot grasp this idea,a remind them of the ice capades and the act in which two lines of skaters revolve around a central point. Explain that the people on the far ends have to skate very fast, whereas the center people barely move. Line four or five students abreast in a cleared area. Have them pivot about one end of the line carefully, making sure they keep a straight line. Ask your students to note and comment on the velocity of each member of the line. This demonstrates the same variation in linear velocity from pole to equator as at different latitudes on a rotating globe. Use the bicycle wheel to demonstrate centrifugal force. Rotate the wheel on its axis, put clay, paper, or small amounts of other materials near the center of rotation. Notice how the material moves. Hand out copies of "It's Moving Away." Have students to complete this outside activity.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Use a globe to show rotation and a model of the solar system to show revolution of planets. Shine a flashlight on the globe and rotate again, discuss how rotation causes the occurrence of day and night. Skillcard No. 17 - Precession @ Skillcard No. 18 - Poles. This activity requires a good camera and photographic skills.
Demonstrate how planets move around the sun and describe the shape of their orbital paths.	Draw diagrams on the chalkboard to illustrate the difference between aphelion and perihelion, have students to copy these diagrams from the board. Write the definition for aphelion and perihelion on the chalkboard and discuss why the earth moves faster at perihelion as it relates to Newton's law of gravitation. * Have students do exercise 3:2 Motions of Earth and its Moon on page 21 of the Review Book. Have students to complete Lab. No. 5 - Earth's Spin. Hand out copies of "Motions of the Earth." Have students complete this worksheet and conduct a question-answer period.
Explain the method used to determine the earth's size.	Read section 3:2 on Earth's Measurements (pages 46-47). Read about the life of Eratosthenes to determine why and how he figured out the approximate size of the earth. Use the world globe to demonstrate Eratosthenes's measurement of the earth and have students locate Alexandria and Syene. Have them measure the distance between these two locations. Knowing that the angle obtained by Eratosthenes 7° 12', have students calculate the circumference of the earth according to the following ratio: 7° 12' is to 360° as the distance between Alexandria and Syene is to the circumference of the earth. $\frac{7^\circ\ 12'}{360^\circ} \quad \frac{7.2^\circ}{360^\circ} \quad \frac{1}{50} \quad \frac{\text{Student's distance measurement}}{\text{Earth's Circumference}}$

Earth's circumference = 50 x student's distance measurement. Answer should be about 40,000 km.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Discuss the difference between the polar circumference of 39776 km and the equatorial circumference of 39843 km. Point out that the difference resulted from the rotation of the earth which caused additional material to accumulate at the equator where the velocity of rotation is greatest.
Compare the terms moss, weight, density, and specific gravity in reference to the earth.	Have students define mass and weight. Write the definition of density and specific gravity on the chalkboard. Use the formula D = to calculate the density of an object.
	Have students do Activity 3-1 on page 48. In this activity students will determine density using mass and volume.
	@ Students can do the lab activity on Skillcard No. 31--Density of the Layers. This demonstrates specific gravity.
	Hand out copies of "Density #1" and have students complete this experiment.
	@ Hand out copies of "Density #2" and have students complete this exp
	@ Hand out copies of "Densities of Liquids" and have students complete this experiment.
	Have students determine the specific gravity of earth materials by doing Activity 3-2 on page 49 of the textbook.
	Have students use the chart on page 95 of textbook to find the specific gravities of hematite, galena, gold, and silver. Have students compare these minerals with the specific gravity of quartz.
	@ Have students determine the densities of fresh water, brine, and an egg, by doing the experiment--Density and Bouyancy on pages 25-26 of Lab Manual.
Distinguish between the crust, mantle, outercore, and inner core of the earth.	Make a drawing of the picture on page 35, figure 2-12. Label the four layers and describe each briefly.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -	Have students make a model of the earth out of styrofoam. Cut out a cross-section and color the layers.
	Hand out copies of the "Earth's Layers and Composition" along with copies of the diagram showing the earth's layers. Have students complete this activity.
Use time zones to tell time.	Have students do Lab No. 9--Time Zones on page 23-24 of the Lab Manual..
	Students can do activity: "Time and Date Around the World." Hand out copies of this activity.
	* Using a map of the United States and colored pencils, shade in states that are in the Pacific Time Zone. Shade in the other time zones using a different color for each time zone. (Hand out copies of United States map.)
	* Hand out copies of "Reading a Time Zone Map" and determine the time at various locations in the United States.
	* List the time zones for Houston, New York City, Los Angeles, and Denver.
	@ Some students could do the exercise "World Travel." Distribute copies of this exercise to students.
e Identify the phases of the moon and show position of earth, moon, and sun for each phase.	Students could make a drawing showing the exact shape of each phase.
	Have students demonstrate the phases of the moon by doing Lab. 6 - Moon Phases on pages 15-16 in the Lab Manual.
	Have students do the experiment on page 55 of textbook. This experiment charts moonrise and moonset for one week betginning with the full moon.
	Have students do "Moon Phases" found on pages 67-68 in Astronomy Guide.
	Students could also do "Observing the Phases of the Moon" included in this guide.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	@ Have interested students with a telescope map the changes in the moon's visible surface.
	* Have students do exercise 3:4 Moon Phases on page 22 of the Review Guide.
Draw and explain a solar and lunar eclipse and understand why it is not a common occurrence.	* Have students make drawing of the eclipses, figures 3-14 and 3-15, page 53.
	Have students find out when the next solar eclipse will occur.
	Distribute copies of "solar eclipse" on page 75 in the Astronomy Guide. Have students read this information.
Describe the features of the moon and compare these to the features of the earth.	Distribute copies of: (a) Ten Discoveries About the Moon, (b) How Are the Moon and Earth Similar, (c) In What Ways Are the Earth and Moon Different? found on pages 60-62 of the Astronomy Guide.
	Have students do Skillcard No. 1 - Size and Distance.
	Have students do Skillcard No. 11 - Dimensions, Part I. (A full moon is needed for this activity.)
	Skillcard No. 12 - Dimension, Part II.
	Skillcard No. 13 - Direction of Orbit, demonstrates that the moon's direction of orbit is from west to east and not east to west.
	Distribute copies of "Lunar Features" on pages 70-73 in Astronomy Guide. Have student do the activities.
	* Have students do Skillcard No. 14 - Craters. (Very simple)
	Students could do Skillcard No. 15 - Shock Lithification.
	Have students list and describe the features of the moon or teacher can give the descriptions and have them supply the correct feature.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	
	Find a good detailed photograph of the moon and have the students locate as many features as possible.
	Students can use papier-machea, cement powder, clay, or "baker's clay" to make a model of the lunar landscape. Label all features.
	Prepare a report about one of the scientists for whom a moon crater or other lunar feature is named.
Explain the theoretical origin of the moon.	Distribute copies of "Evolution of the Moon" on pages 62-64 in Astronomy Guide and have students read this information and then conduct a class discussion.
	The class could be divided into three groups with each group researching one of the three proposed theories on the moon's origin.
	* Posters could be made to illustrate these theories.
	The students could read about the life history of Darwin, Kuiper, or Urey.
	@ A debate on the three theories could be held, with teams giving facts to support their ideas.
	@ Explain to students how George Darwin, an authority on tidal energy, demonstrated that the slowing of the earth's rotation has an important, long term effect on the angular-momentum of the earth-moon system. See page 45T, 3:10 - Moon History for more information. Then have students do the following activities:
	A. Demonstrate angular momentum by using
	a. Turntable. Let one student hold a 5-lb. weight in each while standing on the turntable. Have another student spin the turntable. While the platform is rotating have the student standing on the platform extend his arms. Students should observe what happens.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	This same demonstration can be done using a spinning stool. Let the student hold two textbooks of equal weight in his hands, while the stool is spinning have student extend his arms and observe what happens. B. Have students do these activities from Eighth Grade Earth Science, Texas Education Agency, 1968: a. How to Measure the Velocity of the Moon, an Airplane, or Superman for Fun and Profit b. The Distance to the Moon by Radar c. The Velocity of the Moon C. The above activities are included in this guide along with instructions for "Making a Rolling Coffee Can" and "How the Pippenblooper Works" (See Appendix.)

FORMATION OF PLANETS

PROBLEM: How can planets be formed from eddies in the nebula by comparing the movement of particles on water?

MATERIALS: (List materials)

PROCEDURE:
1. Place two egg beaters in a shallow bowl.
2. Add water to the bowl to cover the webs of the beaters.
3. Gently and evenly distribute some wood shavings on the water.
4. Start one beater in the center of the bowl.
5. Stir slowly and then gradually increase the speed.

OBSERVATION:
1. Notice which shavings move first. Where do they move?
2. What force causes the movement?
3. Do all of the shavings move at the same rate?
4. Does the size of a shaving have any effect on its movement?
5. Stop the beater and observe. Which shavings stop moving first?

PROCEDURE:
1. Resume the beating in the center of the bowl.
2. Have a member of your group start the second beater rotating slowly near the outer edge of the bowl.
3. Alternate the speeds of the beaters.

OBSERVATION:
1. How are the shavings affected by this second movement?
2. How did the alternating speed of the beaters affect the shavings?

CONCLUSION: The chips represented the masses of ____________________ which formed the ______________________________.

COLLISION AND TEMPERATURE

PROBLEM: To test the relationship between collision and temperature.

MATERIAL: Hammer, sheet metal.

PROCEDURE:
1. Hammer on sheet metal for several minutes.
2. Feel metal and tell what happens.

OBSERVATION: Tell what happens to the metal.

CONCLUSION:
1. What heppened to the metal?
2. Why did the temperature change?
3. What theory does this explain?

84

GRAVITY

PROBLEM: To observe the effect of gravity on a horizontal force.

MATERIALS: Rubber ball, lab tablet

PROCEDURE:
1. Drop ball freely from hand or throw the ball up.
2. Throw ball horizontally.

OBSERVATIONS AND CONCLUSIONS:

1. Draw the path of the ball that is dropped or thrown vertically.
2. Draw the path of the ball that is thrown.
3. The force that causes the ball to fall to the floor is

   ______________________________.
4. When the ball is thrown why does it begin to fall toward the floor?
5. What two things determine the path of the ball that is thrown?
6. When a baseball pitcher throws a ball what two forces must he take into consideration to insure getting the ball across the plate?
7. Look at the figure on page 13. What does it tell you about the pull of gravity on both balls?
8. If you could exert horizontal force to overcome the pull of gravity what would happen to the ball when you throw it?
9. The ______________________________ of the planets and the

   ____________________________ of the sun cause the planets to follow elliptical orbits.

MASS, GRAVITY, INERTIA

PROBLEM: To observe how the planets are held in orbit.

MATERIALS: Metal washers, string, plastic funnel.

PROCEDURES: Read Activity, page 14 and watch demonstration.

OBSERVATIONS AND CONCLUSIONS:

1. To keep the string taut (tight) you have to ______________ the speed of the swing washer.
2. How does the size of the washer affect the speed necessary to keep the string taut?
3. In this activity what force is represented by the string?
4. What does the plastic in my hand represent?
5. What does the washer tied to the string represent?
6. When I swing the washer around, what force does this represent?
7. What two forces determine the orbits of planets?
8. These two forces cause the planets to have __________ __________ shaped orbits.
9. What effect does the planet's mass have on its velocity?
10. If all of the planets were the same mass, but different distances from the sun, which ones would move fastest around the sun?
11. What effect does a planet's distance from the sun have on its velocity around the sun?
12. If all of the planets were present sizes (mass), but the same distance from the sun, which ones would move fastest around the sun?
13. Why do planets move faster at perihelion?
14. Why is the sun the center of the solar system? (clue; mass)
15. If the sun exploded and lost most of its mass, what would happen to the planets?
16. If another heavenly body with a greater mass than the sun invaded our solar system, what would happen to the planets?
17. If another heavenly body with a greater mass than the sun invaded our solar system, what would happen to the sun?

NAME____ DATE________________________

MOTIONS OF THE EARTH

1. The earth is the __________________planet from the sun.
2. The average distance of the earth from the sun is ____________________MILES.
3. This distance is called one _________________________ unit.
4. The earth __________________________ on its axis.
5. The direction of the earth's rotation is from ________________ to _______________.
6. As a result of this rotation the sun appears to rise in the ______________ and set in the ________________.
7. The time of one complete rotation of the earth on its axis is called a ____________.
8. The earth ____________________ around the sun in an orbit.
9. The earth's orbit is _________________________ in shape.
10. The period of time required for the earth to make on revolution around the sun is called a _________________________.
11. The length of time it takes the earth to complete one revolution is ______________ days.
12. The earth and all of the other planets move in a __________________ direction around the sun.
13. Because of the shape of the earth's orbit, it is at the point closest to the sun in ______________________(month).
14. This point is called ____________________________.
15. The earth is at the point farthest from the sun in _________________(month).
16. This point is called _______________________.
17. The earth axis is inclined at an angle of _______________°.
18. Since the earth's axis (poles) remains constant during its revolution around the sun, the north pole always points toward the ____________________.
19. Our present North Star is ______________________.
20. In 13,000 years ___________________ will be called the North Pole.
21. Number 20 is true because of a motion of the earth called __________________.

22. The location of the sun's vertical rays on the earth's surface determines the earth's ______________________________.

23. Two reasons the location of the sun's vertical rays change are: ____.

24. ____(two reasons we have seasons).

25. We have the longest day in ____________________, while our shortest day is in ________________________________.

26. The ______________________________causes the differences in length of daylight in winter and summer.

27. A ____________________ is the unit of time corresponding nearly to the orbit of the moon around he earth.

28. A lunar month is ______________________ days long.

29. The earth is rotating and revolving very fast. What keeps us from flying off into space?

TERMINOLOGY: FORM AND LAYERS OF THE EARTH

Earth's Shape and Size
(24-31)

Define or identify the following words. Write in your daily folder.

1. Geodesist
2. Pythagoras
3. Aristotle
4. Erastosthenes
5. Magellan
6. Richer
7. Oblate spheroid
8. Rotation
9. Revolution
10. Centrifugal force
11. Earth's diameter
12. Earth's circumference

Locating Places on Earth
(28-29)

Define the following words:

1. Latitude
2. Longitude
3. Meridians
4. Parallels
5. Prime Meridian
6. Houston's coordinates (latitude and longitude)

Time

Define or identify the following terms:

1. Day
2. Year
3. Month
4. Number of time zones in continental U.S.A.
5. Total number of time zones in U.S.A.
6. Number of time zones
7. Prime Meridian
8. International Date Line
9. Name of time zones in continental U.S.A.
10. Name of Houston's time zone
11. Daylight Savings Time

Name____ Period_____________ Date____________

Experiment_______: Density #1

Problem: How do the densities of different substances compare?

Materials:	Platform balance	Block of foam rubber
	Block of wood	Iron filings

Procedure:

1. Cover each pan of the laboratory balance with a piece of paper.
2. Put the block of wood on one pan and a block of foam rubber on the other pan of the balance.
3. Remove the rubber block and add iron filings to balance the wood block.

Observation:

1. Which has greater mass? Rubber or Wood?
2. which weighs more?
3. Compare the volume of the wood block with the iron filings, which has greater volume?

Conclusion:

1. What affect does size have on density?
2. What is density?

Bonus: FIGURE OUT THE DENSITY OF THE WOOD BLOCK.

Name ______________________________ Period __________ Date __________

DENSITY

Purpose: To compare the densities of three different substances.

Materials: Two weights of motor oil, water, beaker, balance.

Procedure: Determine the mass of beaker. Determine the mass of each of the substances. Mix the oil with water.

Observations and Conclusions:

1. Which substance looks heavier? ______________________________
2. The mass of the beaker is ______________________________ g.
3. The mass of liquid A is ______________________________ g.
4. The mass of liquid B is ______________________________ g.
5. The mass of liquid C is ______________________________ g.
6. Which liquid is actually denser? ______________________________ g.
7. What happens when the oil and water are mixed? ______________________________

   ____
8. What do the results in #7 indicate about the oil and water? ______________________________

   ____
9. Water has a density of 1.0 g/cm^3. What can you conclude about the densities of the oil?

   ____
10. Define density. ______________________________
11. Define mass. ______________________________
12. Define specific gravity. ______________________________
13. Why is density important to the study of the earth's interior? ______________________________

    ____

14. Which of these substances have densities less than a cup of water? (a) a cup of baby powder (b) a cup of sand (c) a cup of batter

15. Which of these substances have densities greater than a cup of water? (a) a cup of sand (b) a cup of rocks (c) a cup of butter

16. Look at the densities of the layers of the earth on page 35 and explain the effect of density on the way the layers are arranged.

____

____

Name ______________________________ Period ____________ Date ________

Experiment ______: Densities of Liquids

Problem: How do liquids of different densities arrange themselves?

Materials:
Glass Jar
Water
Cooking Oil
Syrup
Block of wood
Foam rubber
Iron filings

Procedure:

1. Put 1/4 cup of water, 1/4 cup of cooking oil, and 1/4 cup of syrup in a glass jar.
2. Shake the jar and let it stand for 15 or 20 minutes.

Observation:

1. How are the substances arranged in the jar?
2. Do you need to weigh the substances to determine their relative densities?

Procedure 2:

1. Put the block of wood, the foam rubber, and the iron filings in a dry jar.
2. Shake the jar.

Observation 2:

1. How are the substances arranged in the jar?

Conclusion:

1. Are the substances arranged according to their densities?
2. Why do liquids arrange themselves in order of density?

NAME_______________________________ DATE____________________

EARTH'S LAYERS AND COMPOSITION

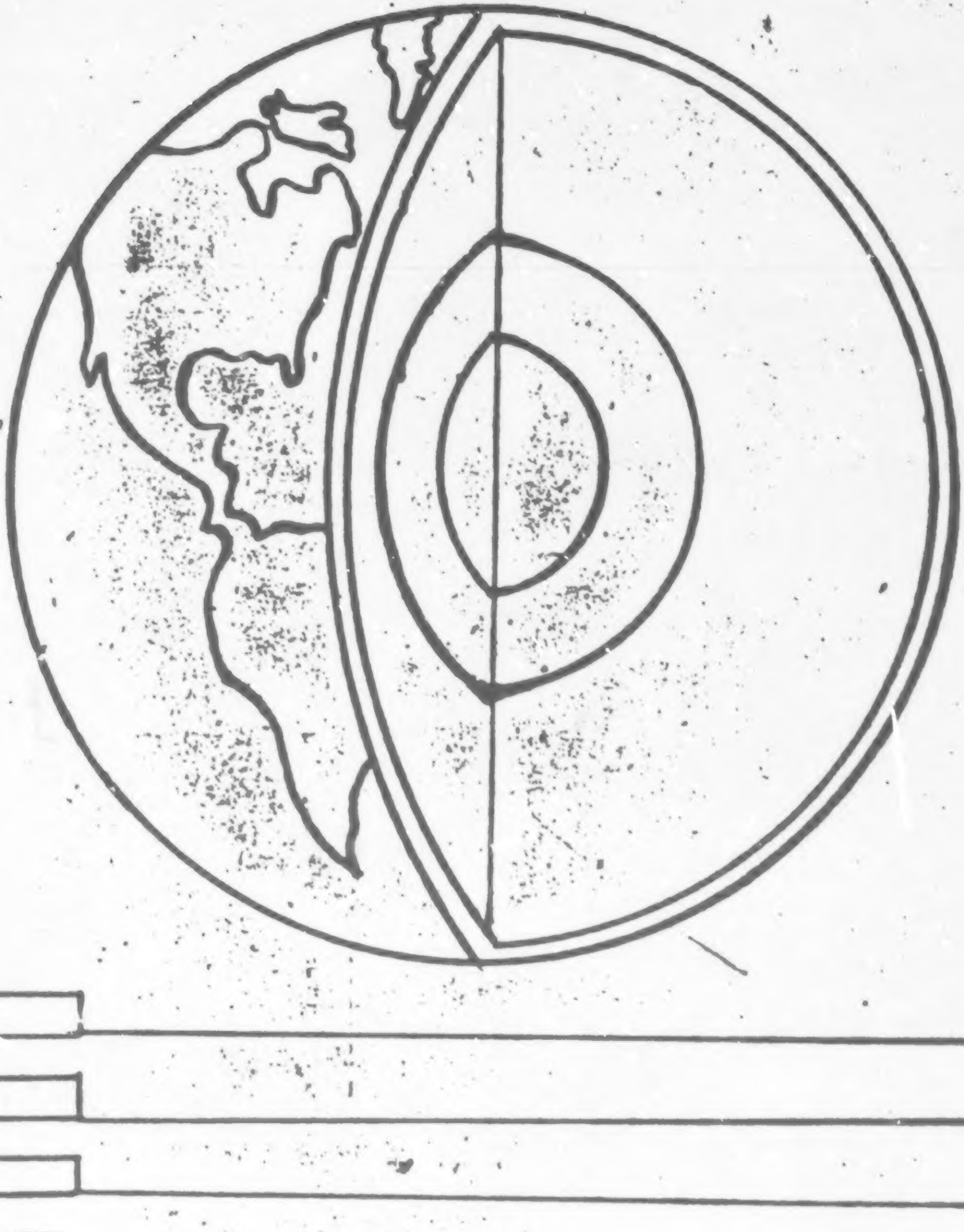
I. Label each of the earth's main parts on diagram. Color each layer.

II. Complete the following chart:

Layer	Composition	Thickness (Miles)
1.		
2.		
3.		
4.		

III. Completion:

Our earth has (1)_______(number) layers. The outermost layer is the (2)____________________ and is composed of (3)____________________and (4)____________________. The second layer is the (5)____________________ containing such (6)____________________. The third layer called the (7)____________________ is (8)______________(state) and contains (9)a_______________. The innermost layer, the (10)______________________ is (11)________________(state) and contains (12)______________________. Density of the material of the earth ranges from (13)_________ times as heavy as water at the center of the earth. The thickest part of the earth is the (15)__________________ which is (16)______________ miles thick with the (17)______________________________ second and the (18) _______________ third. The thinnest part aof the earth is the (19)____________________ which ranges from (20)___________ miles under the oceans to (21)_________ miles under the continent.



TIME AND DATE AROUND THE WORLD

Procedure

1. Look at the bottom of your map and find the Prime Meridian (0°).
2. It is 6:00 P.M. Monday at the Prime Meridian. Write this time in the margin.
3. Going to your right (east), write the time on each meridian.
4. Now go to your left and write the time on each meridian. Remember the International Date Line.
5. Color all of the zones that already have Tuesday.

Time and Date Around the World

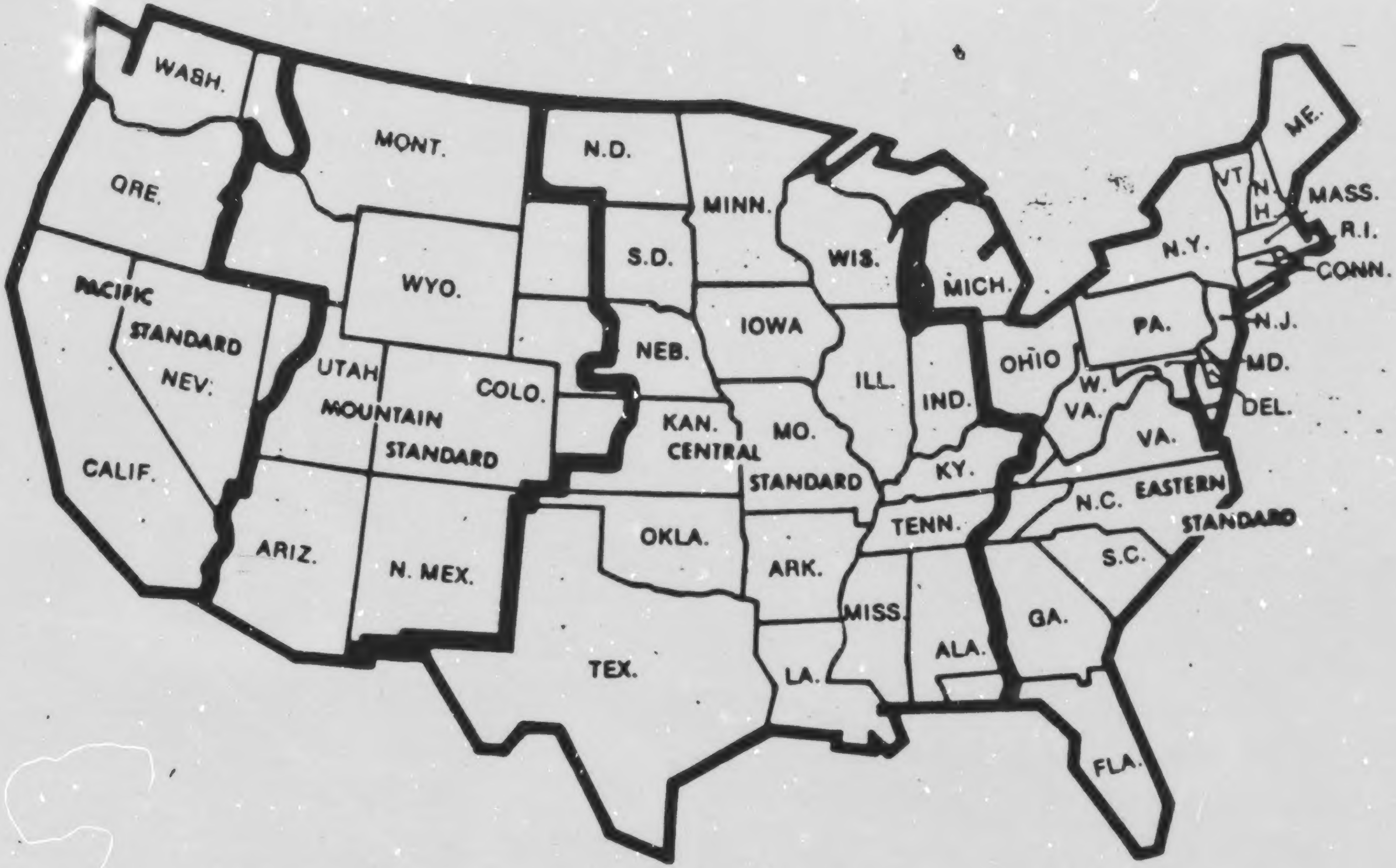
Purpose: To see how Standard Time and date differ around the world.

Materials: Map of the world, pencils, crayons

Procedure: Listen carefully to teacher and follow directions.

Conclusion Questions:

1. What time and day did you find at the 90°E meridian as you went eastward?
   ____
2. The same meridian appears at the western end of your map and should show the same day and time. Does it? ______________________________
3. What time is it in New York? ____________________(give day and time)
4. What time is it in London? ____________________(give day and time)
5. Compare the time in London with that in New York (which is later or earlier; approximate number of hours)
   ____
6. Compare London time to San Francisco. ____________________
7. What time is it in Sidney, Australia? ____________________
8. Which meridian has the most advanced time? (that is, where is it the latest?
   ____
9. How many time zones already have Tuesday? ____________________
10. In how many hours will it be Tuesday all over the world?
    ____
11. On what does time depend, latitude or longitude?
    ____
12. Why? ______________________________
13. How many time zones are there in the world? ____________________
14. According to your map what time and day is it in Houston, Texas?
    ____
15. In what time zone is Houston located? ____________________


WASH.
ORE.
CALIF.
NEV.
PACIFIC STANDARD
MONT.
WYO.
UTAH
COLO.
MOUNTAIN STANDARD
ARIZ.
N. MEX.
N.D.
S.D.
NEB.
KAN.
OKLA.
TEX.
MINN.
IOWA
MO.
CENTRAL STANDARD
ARK.
LA.
WIS.
ILL.
MISS.
ALA.
TENN.
KY.
IND.
MICH.
OHIO
W. VA.
VA.
N.C.
S.C.
GA.
FLA.
PA.
N.Y.
VT
N. H.
ME.
MASS.
R.I.
CONN.
N.J.
MD.
DEL.
EASTERN STANDARD

READING A TIME ZONE MAP

Directions: Use a map of the United States to help you answer these questions:

1. Your state is in the ____________________ Time Zone.

2. A total of ____________________ states have parts in two different Time Zones.

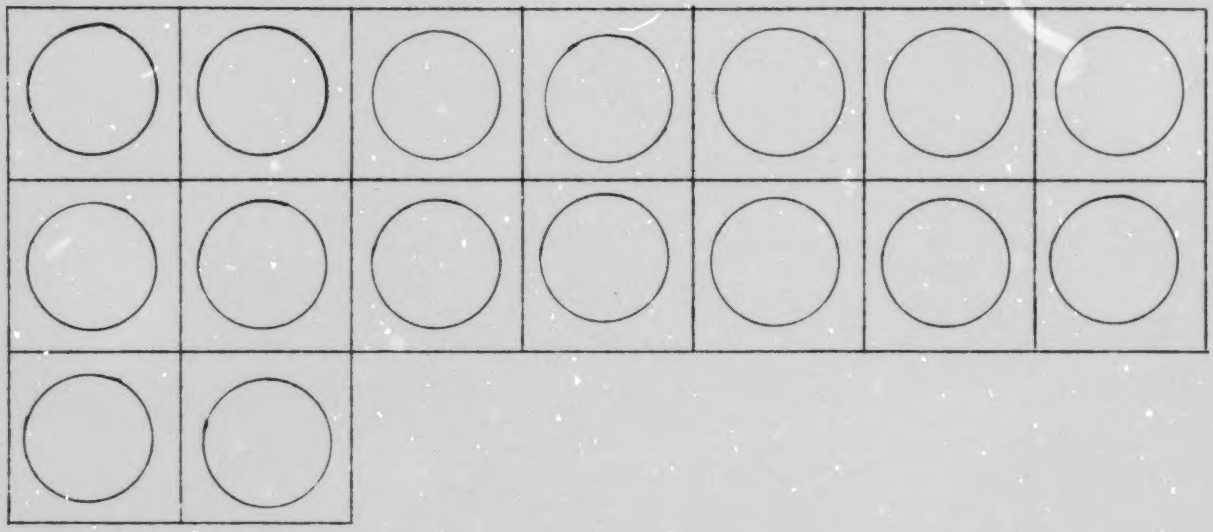
3. The difference between the Mountain Zone and the Eastern Zone is ____________________ hours.

4. When it is 6 P.M. in California, it is ____________________ in Alabama. The plane trip takes four hours. You leave Pennsylvania at 1 P.M. and you arrive in Colorado at ____________________.

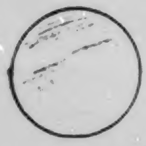
ACTIVITY: Observing the Phases of the Moon

As you look up into the sky in the evening, you will realize that the moon changes from night to night. We will observe the changing of the moon's phases over a 16 day period. The total change in phases takes almost a month, so we will only see a part of the series.

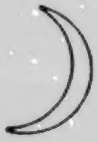
Fill in the chart below by shading the circles to represent the appearance of the moon on the night specified. Notice that the times of moon rise and moon set are given so you will know when to make your observation.



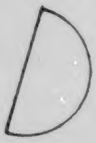
Below are pictured the main phases of the moon through the entire cycle. Refer to the table on page 376 of your text.



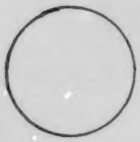
a) (invisible)



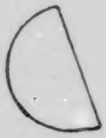
b)



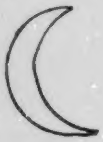
c)



d)



e)



f)

a) ____________________

b) ____________________

c) ____________________

d) ____________________

e) ____________________

f) ____________________

ACTIVITY TWENTY-ONE: HOW TO MEASURE THE VELOCITY OF THE MOON, AN AIRPLANE, OR SUPERMAN FOR FUN AND PROFIT

NOTE: It will be necessary to give instructions for reading a protractor before this activity.

WHAT YOU WILL NEED:

The rolling coffee can from the previous activity
Pippenblooper (with timing plug) or timer
Protractor and straw
Ruler

(Can be done in an ordinary classroom if electrical outlets are available)

HOW TO GET STARTED:

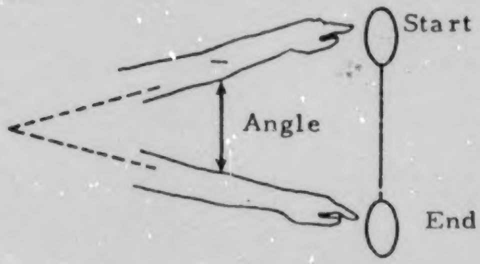
At the conclusion of the previous activity we asked how you could measure the velocity of the moon or of a flying airplane. The basic problem is that you cannot stand directly underneath these objects at the "start" and "stop." The idea we want to develop is that we can sight them at the "start" and "stop" and measure the rate of change of the angle of sight.

OBJECTIVES:

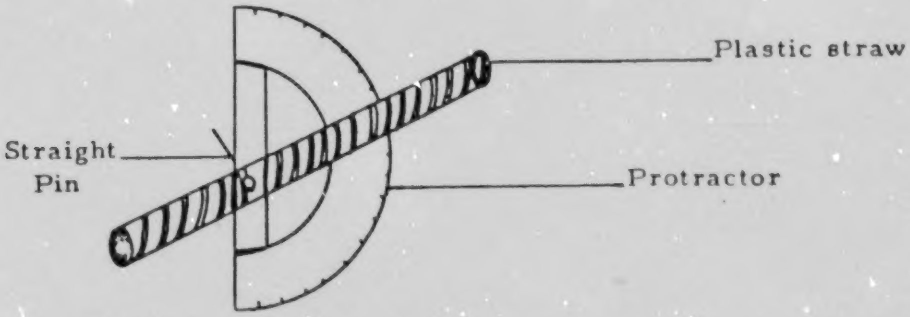
Students should be able to read a protractor, use the protractor to measure an angle and to construct an angle whose size is given in degrees. Most students should be able to measure the rate of change of an angle of sight to a moving object and to explain by means of a diagram how the size of this angle depends upon the distance from the point of the sighting to the moving object.

THE ACTIVITY:

Suppose you were to stretch out your arm and point your finger at the coffee can as it moved along. Your arm would move through an angle like this:



The size of the angle, in degrees, would be a kind of measure of the distance moved--what we call an indirect measure. Dividing by the time would give a velocity measured in degrees per pip, (degrees/pip). Of course it wouldn't be easy to get an accurate measure of the angle this way. Put a straight pin through a straw and put it at the center of the protractor, like the diagram below.



Looking through the straw is like pointing your arm. By moving it across the protractor as you follow the coffee can you can easily measure the angle (be sure you don't move the protractor).

Measure the velocity of the coffee can twice using this new idea. Divide the labor, just as you did in the previous activity. The starter, stopper, and time keeper do their jobs just as before. This time the distance measurer sights through the straw. In actual practice, the straw is awkward to look through. The measurer can put the protractor on the floor or table top and point the straw at the coffee can before it is released. He writes down this original position of the straw, recording the angle the straw crosses on the protractor. Then the coffee can is released and timed, as before. When the coffee can is stopped, the measurer moves the straw (but not the protractor!) so that it is pointing once again to the coffee can. The final position of the straw is again read on the protractor. The difference in the two angle readings is the number of degrees the coffee can moved. Divide the number of seconds required and you have the angular velocity of the coffee can in degrees per second.

Angle moved: ____________________

Time taken: ____________________

Angular velocity: ________________

Now have the measurer move the protractor about twice as far away from the coffee can, and repeat the activity. Do you get the same answer? Why?

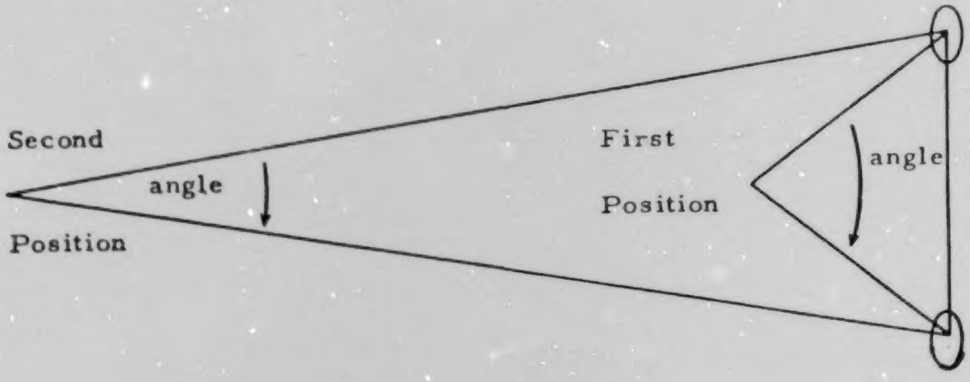
Angle moved: ____________________

Time taken: ____________________

Angular velocity: ________________

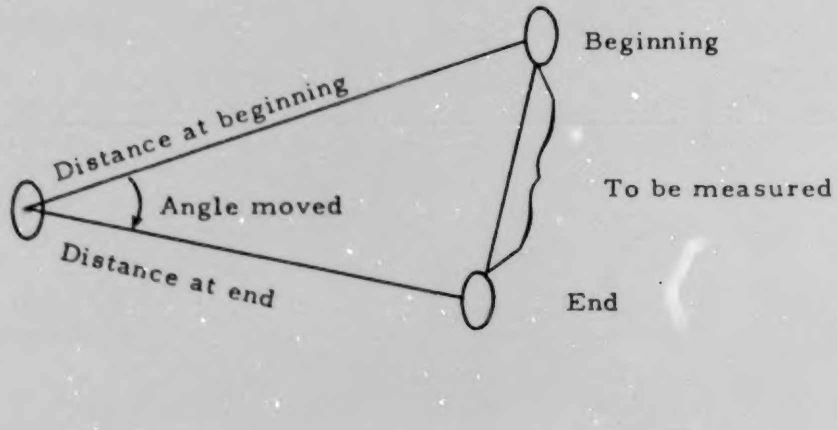
WHERE TO GO FROM HERE:

The students should have decided that the size of the angular velocity of the coffee can depends upon how far away the measurer stands. The following blackboard sketch may help in the discussion of why this is so.


Second
Position
angle
First
Position
angle

Measure the two angles with a protractor. Are they different? This activity is not a disaster, however, for the teacher can salvage it by a discussion much like the following:

> How can you tell how far the coffee can really moved? If you know how far away you stood you might be able to make a drawing, which you could measure. (Remember, we are thinking about measuring how fast the moon moves across the sky, so we are forced to measure indirectly.) But unless we have a huge sheet of paper, we will have to make things smaller. What was the distance between the coffee can and the protractor at the beginning of the first trial? At the conclusion of the first trial? (It may be necessary to rerun the experiment to get this data.) What was the angle moved? Use these three numbers to make a construction on the blackboard like the one below:


Beginning
Distance at beginning
Angle moved
To be measured
Distance at end
End

ACTIVITY TWENTY-THREE: THE VELOCITY OF THE MOON

WHAT YOU WILL NEED:

A post in the school yard (about 4' high)
2 wooden stakes
A long string (or rope)

HOW TO GET STARTED:

This activity is really a problem based upon the results of the previous two activities. We want to arrive at a value for the apparent velocity of the moon. Since the activity hinges around a scale drawing, it may be done as a teacher demonstration for low-ability classes. Success lies in the discussion you are able to evoke.

OBJECTIVES:

Most students should be able to make scale drawings, explain relative motion, and name two reasons why the moon may only look like it is moving rapidly.

THE ACTIVITY:

Now that we have seen some ways to measure the distance to the moon, we can find the velocity of the moon across the sky by scale drawing, too. But you'll have to take the data at home at night! When you are ready to "shoot the moon"--remember which direction the moon appears to travel. Set the axis of the protractor parallel to this path and tape protractor securely to prevent it from being moved. If you should set the protractor at right angles to the moon's path--why would it be difficult to measure the angular distance? Another problem in sighting the moon over the protractor is correcting for angular inclination. Try taping the protractor to the lid of a box or the cover of a large hard-backed book, rolling a stick between the box and lid until you are able to sight through a straw pinned to the center of the protractor. For more comfortable reading, set the box on a post or other suitable mount and weight it down to keep it from accidentally moving. Stick a pin in the outer edge of the straw and prick a hole in the paper when the first sighting is made. Record the time when the first sighting is made. Come back later and move the straw to line up with the moon for a second sighting and prick a hole in the paper with the outer pin. Record the time. Draw a line between the first outer point and the center of the protractor. Draw a line between the second outer point and the center of the protractor. How many degrees did the moon travel? This is the angular distance. How much time did it take to travel this distance? Angular velocity equals angular distance divided by time or __________ degrees/hour.

ACTIVITY TWENTY-TWO: THE DISTANCE TO THE MOON BY RADAR

WHAT YOU WILL NEED:

Superballs
Ruler (with groove, for launching ramp)
Books
Pippenblooper (with time plug) or timer
Meter sticks

(Can be done in an ordinary classroom if electrical outlets are available.)

HOW TO GET STARTED:

If this activity is begun soon after Activity 21, students should see a need for what we are doing.

Perhaps you have heard that we can measure the distance to the moon by bouncing a superball (instead of radar) off a wall (instead of the moon) to show how this works.

This is an analogy activity. Since it is not practical for students to use radar and make an actual measurement of the distance, we will use something that works much like radar to measure the distance to the wall and the processes which astronomers use to measure the distance to the moon are really the same kind of processes. If the student understands one process, he should, in theory at least, be able to understand the other.

OBJECTIVES:

Most students should be able to calculate distances when given the velocity of an "indicator" and the time required for a round-trip of this "indicator."

THE ACTIVITY:

You will need a superball, some books, a grooved ruler, and a timer. Put one end of the ruler on the books on the floor so it makes a launching ramp. Roll the superball down the ramp and measure its velocity. It is probably best to let the ball go a pip, or second, and mark where it is some number of pips (five), or seconds (three) later.

If you always let the ball go from the same place on the ruler, it should roll across the floor with the same velocity. When you have decided on the best value for this velocity, write it here: Velocity ________________.

Now you are ready to hit the wall (moon). Let the ball go from the same place on the ruler, so that it will have the same velocity you wrote down above. This time let the ball go all the way over to the wall and come back. Measure the time that it takes for the ball to leave the ramp, hit the wall, and return. Repeat until you feel that you have the best answer for this time.

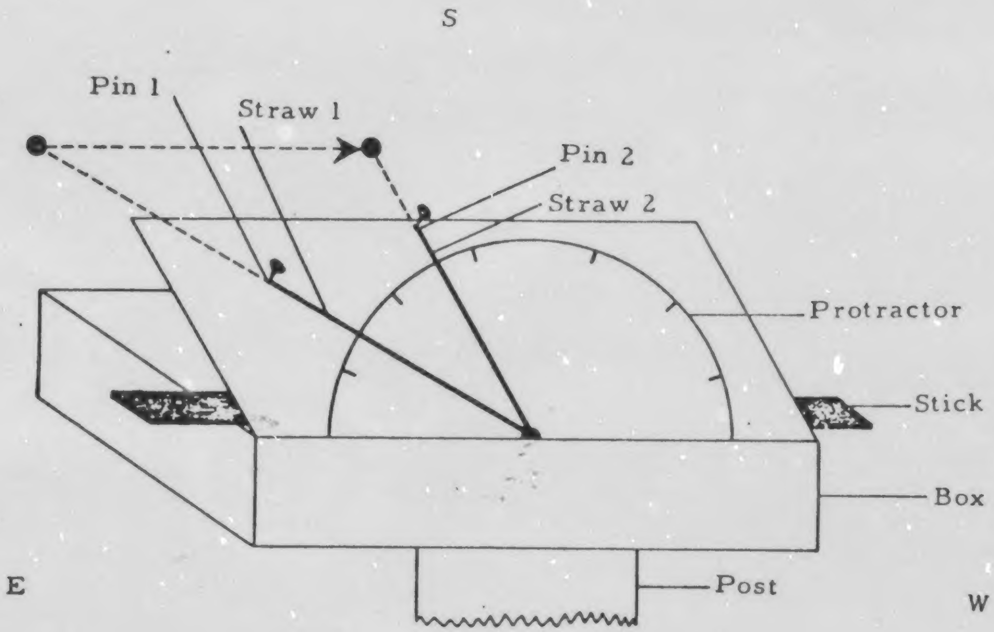
The velocity of the ball tells you how far the ball will roll in one pip or a second. You should know how many pips or seconds it took for the ball to make the round trip also. The length of the round trip would be how far the ball goes in one pip or second times the number of pips or seconds. How does this distance relate to the distance to the wall?

Time for the round trip:______________________________
Distance of the round trip:___________________________
Distance to the wall:_________________________________

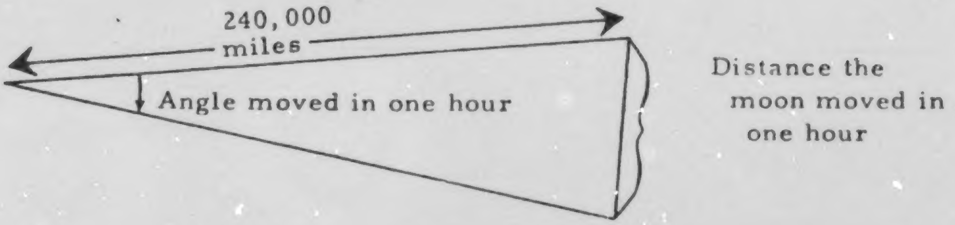
WHERE TO GO FROM HERE:

It took a radar signal 2.6 seconds to go to the moon and back. Radar travels at a speed of 186,000 miles each second. How far is it to the moon?

At this point you might want to have a brief discussion of the moon or of space exploration. However, since the following activity uses the results of the last two, you will not want to delay it for too long.


S
Pin 1
Straw 1
Pin 2
Straw 2
Protractor
Stick
Box
E
Post
W

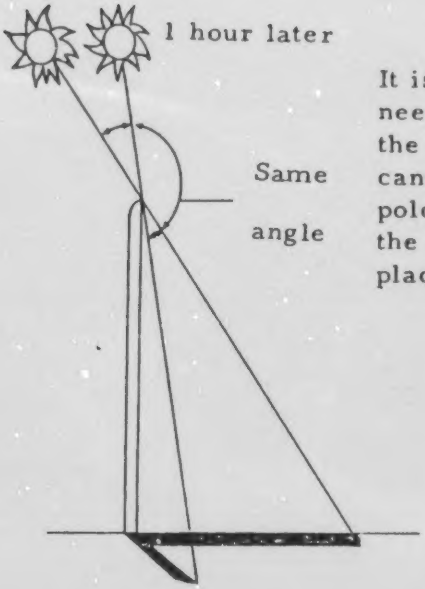
Make a scale drawing like the sketch below:


240,000 miles
Angle moved in one hour
Distance the moon moved in one hour

Use a scale of 1 cm = 10,000 miles. For the angle, measure the number of degrees through which the moon moved in an hour. Measure the length of the third side of the triangle. This represents how far in miles the moon appeared to move in one hour, and is the apparent velocity in miles per hour. (It should be about 60,000 miles/hr.)

Before we finish, we should ask ourselves if we have "proved" that the moon really moves this fast. There is at least one other way we could "see" this velocity. The moon could stand still while the earth rotated through the angle you measured. If this were the case, the number we obtained would be the relative velocity of the moon. That is, the number would be how fast it appears to move in relation to our position on the earth. Which is really moving? The earth? The moon? Or both? How could we find out?

A. If the sun and moon stood still while the earth rotated, the measured apparent velocity of the sun and of the moon should be the same. That is, they should both move across the sky about 15° each hour. Here is a place for another activity. At first it would seem that we could sight the sun with a straw and protractor, just as we did for the moon. But don't do it, because of the possibility of damaging your eyes. We can do something else. As the sun moves across the sky, the shadows it casts move along the ground. The sketch below shows the relationship.



It is the angle (either one) that we need to measure. However, unless the sun is directly overhead, we cannot expect the lines from the pole to the ends of the shadows and the pole itself to be in the same place.

UNIT II

Earth's Matter

Chapter 4: Matter

(Time Allotment: 10 days - One Semester)
5 days - Two Semesters)

Major Concepts to be Taught

The forms of matter include mixtures, chemical compounds, and elements
Atoms of elements have a definite structure
Each kind of matter occurs in one of three physical states

Instructional Objectives

The student should be able to

- B . Define matter and its forms (mixtures, chemicals, compounds, elements) and give examples of each.
- . Conclude that everything is made of atoms and identify the three parts of an atom according to their individual characteristics.
- . Explain the difference between the chemical and physical properties of atoms and give examples to support any statements.
- . Write the symbols for common elements and understand how to use the periodic table and charts as references.
- B . Name the three states of matter, give examples for all three states, and explain how substances may change from one state to another.

Assessment Guidelines

The student will will

- Define matter.
- Label the following items as either compounds, mixtures, or elements:
  - gasoline (C)
  - gold (E)
  - salt (C)
  - soil (M)
  - water (C)
  - oxygen (E)
  - hydrogen (E)
  - seawater (M)
  - blood (M)
- Define atom.
- Name the three parts of an atom.
- Explain the differences between the chemical properties of an atom and its physical properties.
- Name ten elements and give the symbol for five.
- Name the three states of matter
- Name and describe the characteristics of the three states of water.
- Explain which factors are necessary for water to change from one state to another state.

Materials

Textbook: Focus on Earth Science, pages 62-79

Lab Manual: "Life Science--A Learning Strategy for the Laboratory"
    No. 11 - Mixtures and Compounds
    No. 12 - Electrical Charges
    No. 13 - Ions
    No. 14 - States of Matter

Earth Science Activity-Centered Program, Teacher's Guide
    Page 17 - Extension to activity
    Page 18 - Extension to activity
    Page 19 - Additional activity, page 71
    Page 21 - Extension to activity
    Page 21 - Additional activity, page 73
    Page 23 - Extension activity

Focus on Earth Science Review and Reinforcement Guide
    4:1 Organizing Matter - page 23
    4:2 Matter Crossword Puzzle - page 24
    4:3 Keeping Track of Particles - page 26
    4:4 Classifying Common Forms of Matter - page 28

Films:

    M6197 - The Atom and the Environment (1971) 22 min.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Define matter and its forms (mixtures, chemical compounds, elements) and give examples of each.	Ask for definitions of matter, mixtures, chemicals, compounds, elements.
	Have students do Lab No. 11 - Mixtures and Compounds In this activity students will compare mixtures and chemical compounds.
	Give students about 20 minutes to list 50 examples of matter present in the classroom; then compare lists. The comparison will likely lead to a discussion and definition of matter.
	Display substances that are elements, compounds, or mixtures.
	Hand out copies of "Separating a Compound" and have students to this activity. Also have students do "The Flame Test" activity which follows.
	Have students complete the exercise - Organizing Matter on page 23 of Review Book.
Conclude that everything is made of atoms and identify the three parts of an atom according to their individual characteristics.	Draw a diagram on the board or use an overhead projector and draw a diagram to explain the structure of an atom.
	Have students construct models of atoms (hydrogen, lithium, buron, etc.). The easiest model is one that lies in a single plan, but encourages students to try to make three-dimensional models. Wire from coat hangers can be used to form wire ring. A wire shaft can hold the nucleus together. Anchor the wire in modeling clay or a small wood block. Use different colors of clay to represent the basic parts of the atom. A variety of materials can be used to represent the parts of the atom, such as beads, styrofoam balls, gum drops, and gum balls. Encourage students to make these models out of class.
	Have students to observe the periodic table on page 521. Explain that is is an arrangement of the elements according to their atomic numbers.
	Encourage students to discover how to find the atomic mass number. Then reinforce the concept (the atomic number is the sum of its number of protons and neutrons) by having students to find some atomic mass numbers.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Have students do Lab 12 - Electrical Charges on page 29 of Lab Manual. Using a pinwheel, have students locate exact position of a moving body. This activity is on page 66 of textbook. Students could do Lab No. 13 - Ions on page 31 of Lab Manual. Students can do the activities on finding the atomic number and atomic mass number (atomic weight). You can make hand-outs of the pages which best meet the needs of your students. @ Have students to plot the atomic number versus the atomic mass number on graph paper. Use page 107 in "Science Understanding Your Environment," Grade 6. Illustrate the small mass of electrons. Have the students place 92 small pebbles in a jar. Place the jar on a balance and move the masses until the two balance pans are exactly balanced. Then add 1 grain of sand. Note the lack of any effect on the balance. The activity on pages 26-27 of the Review Guide will hel students understand atomic number and mass number.
Explain the difference between the chemical and physical properties of atoms and give examples to support any statements.	Assign More Ideas to Explore, page 79 of the textbook. Use a small plastic medicine bottle containing several tiny styrofoam balls. Rub the bottle against nylon or wool cloth and the styrofoam balls inside the bottle will become charged and will either attract or repeal one another. Students can observe the tiny balls jumping within the bottle. Some students may do additional activity on page 73 of Activity Book. Define chemical and physical properties and use the board to list examples of both. As a part of the class discussion of chemical properties, emphasize that chemical reactions account for many changes in materials. Use the activities below to demonstrate this concept: a. Have your students make the compound iron sulfide. Mix 7 grams of iron filings and 4 grams of sulfur. Have them describe

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	each element. Place the mixture in a test tube and heat. Students should record the results of their observations. b. Heat one teaspoon of sugar in a test tube. Record the changes which occur as the sugar is heated. c. Have the students observe the rusting of iron. To do this, have them rinse the steel wool with vinegar to remove the coating, then rinse again with water. Place the moistened steel wool in a flask with a rubber stopper. Record the temperature daily for one week. Observe the results.
Write the symbols for common elements and understand how to use the periodic table and charts as references.	Students could look at pages 521 of Appendix B and establish their own list of "common elements." Have students list the familiar elements and their symbols on the board and then add to the list any elements that are essential to earth science studies. Develop a game on symbols and have students make up the rules.
Name the three states of matter, give examples for each of the three states, and explain how substances may change from one state to another.	The activities included in this guide can be used to demonstrate and explain this concept. Make copies of the activities which best meet the needs of your students. Have students do Lab No. 14 - States of Matter on page 85 of Lab Manual. Show the students a substance in three states and have them explain how temperature and pressure causes it to change from one state to another. * As an oral exercise, ask the students to name as many substances as possible for each of the three states of matter. * Students could use the chart on page 28 of the Review Guide, to classify common forms of matter.

NAME ______________________________________ Period __________ Date __________________

Experiment _______: Separating a compound

Concept: A substance, such as water, which contains only one kind of molecule, is a compound. A compound cannot be broken down into simple parts by a physical change.

Problem: What element and compound are produced when hydrogen peroxide, a compound, breaks down?

Materials Needed: (Per table)

Baby food jar
Wood splint
Matches
Hydrogen peroxide
Manganese dioxide
Plastic spoon

Note: Demonstrate the proper technique for testing the odor of a liquid. Punch a hole in the top of the baby food jar.

Procedure One:

1. Fill the baby food jar 1/3 full of hydrogen peroxide.

2. Look at the hydrogen peroxide in the jar and answer the following questions.

Observations:

1. Does hydrogen peroxide have a color?

2. Does hydrogen peroxide have an odor?

3. What common compound does hydrogen peroxide look like?

Procedure Two:

1. Add 1/2 spoonful of manganese dioxide to the hydrogen peroxide in the baby food jar.

2. Swirl the jar to mix the contents of the baby jar.

3. Place the lid tightly on the baby food jar.

Observations:

4. Are bubbles of gas formed?

5. Do you see a color or smell an odor?

Procedure Three:

1. With a match, light one end of the wood splint.
2. Blow out the wood splint.
3. Hold the glowing splint over the opening in the jar lid.

Observations:

6. What happened to the glowing splint?
7. Ask your teacher for the formula of hydrogen peroxide. What element was produced?
8. What compound was produced?

Conclusion:

1. What can you conclude about hydrogen peroxide?
2. What is one property of hydrogen peroxide?

Conclusions and Related Questions:

1. Define mixture.
2. Define compound.
3. What are some properties of mixtures?
4. What are some properties of compounds?

NAME____Period____________Date__________________

Experiment________: The Flame Test of the Spectrum

Purpose: To investigate the flame color.

Materials:
- A paper clip
- A cork or clothes pin
- Alcohol burners
- Goggles

Chemicals:
- Baking soda
- Barium chloride
- Calcium chloride
- Copper II sulfate
- Potassium chloride
- Sodium chloride
- Strontium chloride
- Lithium nitrate

NOTES TO THE TEACHER:

DO NOT USE BUNSEN BURNERS ! ! ! ! !

The chemicals should be identified only by numbers.

Procedure:

1. Straighten a paper clip and make a small loop in the end to hold a small sample of a chemical compound
2. Place a small sample of one of the compounds in the loop.
3. Hold the clip with the clothes pin or insert the clip into the cork and place the loop into the flame.
4. Record the results on the data table on the next page.
5. Repeat 2, 3, and 4 for each of the chemical compounds.

Use the key below to decide what element was present in each of the chemical compounds heated to cause the color observed in the flame.

Elements	Color
Barium	Pale green
Calcium	Orange-red
Copper	Blue-green
Lithium	Crimson red
Potassium	Violet
Sodium	Yellow
Strontium	Crimson red

Data Table

Materials (chemicals)	Color of Flame	Element Present
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		

"PROTONS PLUS"

I. DIRECTIONS: The table below lists fifteen different atoms. The number of protons and neutrons in each atom is also listed. Use that information to find the atomic weight of each of these elements. Write your answer in the last column.

Name of Element	Number of Protons	Number of Neutrons	Atomic Weight
1. cobalt	27	32	
2. zinc	30	35	
3. krypton	36	48	
4. hydrogen	1	0	
5. potassium	19	20	
6. gold	79	118	
7. arsenic	33	42	
8. sulfur	16	16	
9. iodine	53	74	
10. tungsten	74	110	
11. silver	47	61	
12. uranium	92	146	
13. lead	82	125	
14. calcium	20	20	
15. oxygen	8	8	

II. DIRECTIONS: Complete the following chart by filling in the blanks. Use the Periodic Table on page 14 to help.

P rotons
E lectrons
N umber

Atom	Symbol	Atomic Number	Number of Protons	Number of Electrons
1. hydrogen				
2.		5		
3.				10
4.	Cr			
5.			7	
6. gold				
7.		13		
8.				33
9.	He			
10.			14	
11. iron				
12.	F			
13.		30		
14.			16	
15.				20
16.	Sn			
17. chlorine				
18.			6	
19.		80		
20. iodine				
21.	Kr			
22. uranium				

ACTIVITY 4

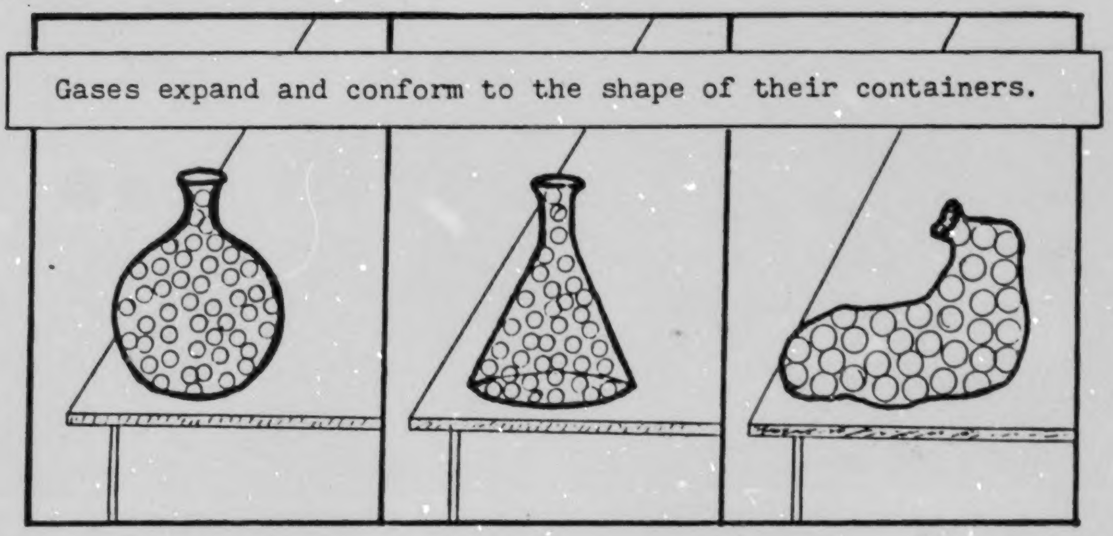
"IT'S A GAS"

DIRECTIONS: Read the directions below, then answer the questions that follow.

Matter can be a solid, a liquid or a gas. Those conditions are called the "states" of matter. One state of matter can change into another at a certain temperature and pressure, but each state has its own properties which identify it. The characteristics or traits of a substance are called properties. Hardness, color, odor, and texture are examples of kinds of matter.

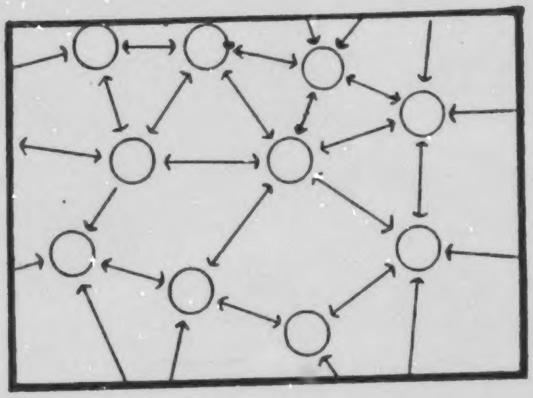
When matter is in the gaseous state, it is very delicate and flimsy. Most of the time you cannot see, feel, smell or touch it. To many people these substances are puzzling, even though they appear everywhere in life. Gases appear in the air you breathe, the air of inflated tires, the wonderful smells of food cooking and even in hospital operating rooms to put patients to sleep.

Scientists have determined that gases have no shape of their own. When gases are put in a container, they expand to fill the container.


Gases expand and conform to the shape of their containers.

Gases take up space, but they do not take up a definite amount of space. A gas is always moving and will spread out in all directions. A gas will spread upward.

Why do gases behave this way? In a gas the molecules are spaced far apart, so they are free to move in all directions. The molecules move so fast that they cannot be held in one place. These molecules bump into each other constantly, but they just rebound like bumper cars in a carnival. It is this activity that accounts for the behavior of a gas.



QUESTIONS

1. What are the three states of matter?
2. Define the term "properties."
3. List two characteristics of a gas.
4. Explain why gases do not have a definite shape or definite amount.

IT DOES MATTER!

ACTIVITY 5

"FULL OF GAS"

DIRECTIONS: Get the materials listed below and complete this activity by following the steps in the procedure. You must complete the entire activity before going to the next activity.

MATERIALS NEEDED:

balloons

a platform balance

a ruler

PROCEDURE:

1. Weight a balloon and record its weight.
2. Blow air into the balloon and weigh it again. Record the weight.
3. Subtract the weight of the balloon filled with air still in it. Record the length.
4. Measure the length of the balloon with the air still in it. Record the length.
5. Using the same balloon let all the air out of the balloon, and measure it again. Record the length.
6. Answer all the questions under the conclusion.

CONCLUSION:

1. How much did the length change?
2. How did you determine that gas has weight?
3. How did you determine that gas takes up space?
4. What happens to the air when you let it out of the balloon?

   Does it still have the same shape?

   Does it still have the same weight?

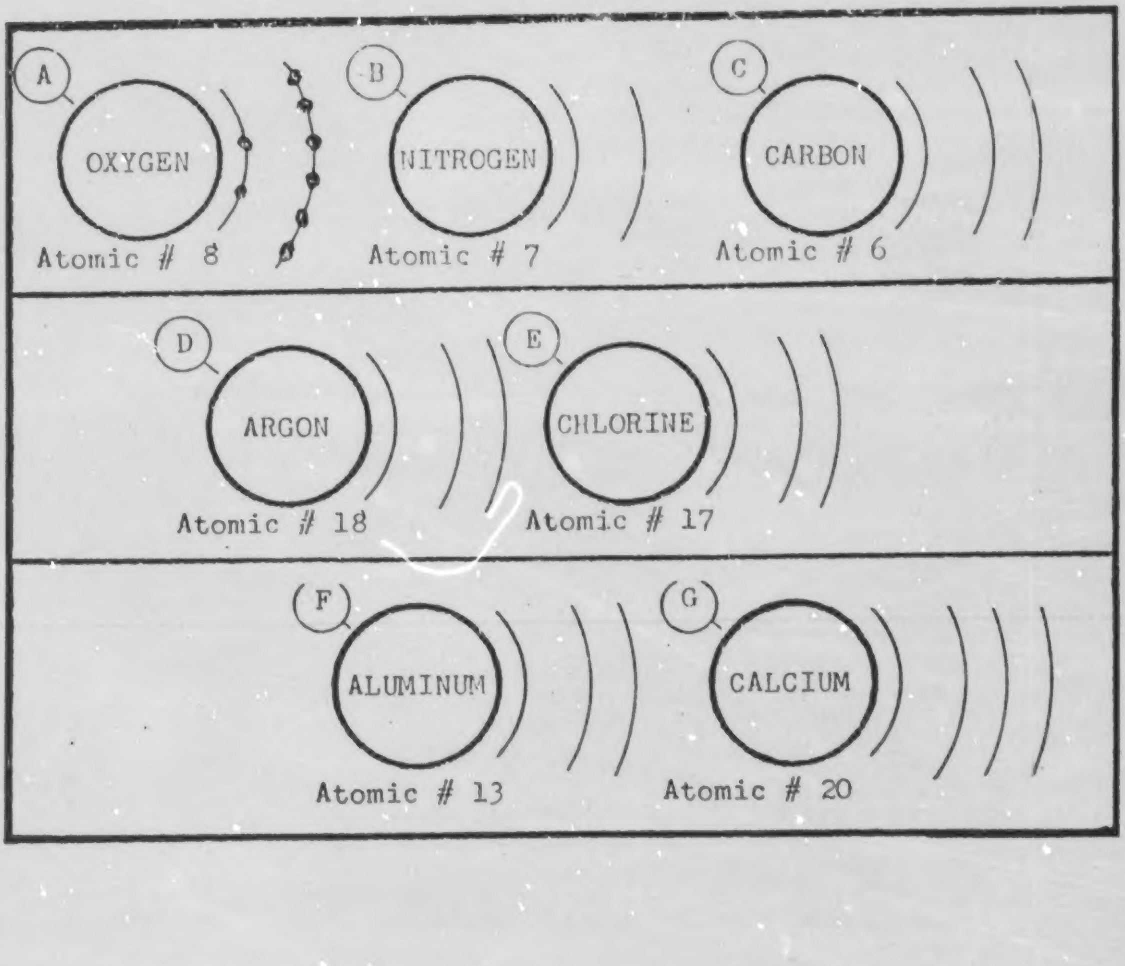
   Does it take up the same amount of space?

   Explain your answers.

ACTIVITY 9

"DIAGRAMING ATOMS"

DIRECTIONS: Complete the following pictures by filling in the electrons. "A" has already been done for you. You must do all correctly before completing this package. These pictures are symbols for atoms and their electron orbits.


A
OXYGEN
Atomic # 8
B
NITROGEN
Atomic # 7
C
CARBON
Atomic # 6
D
ARGON
Atomic # 18
E
CHLORINE
Atomic # 17
F
ALUMINUM
Atomic # 13
G
CALCIUM
Atomic # 20

Drill on Periodic Table

No Talking -- This is for a grade.

Use your table -- Only ONE at a time at big charts.

Name of Element	Symbol	Atomic Number	Atomic Weight (Round Off)	Number of Electrons	Number of Protons	Number of Neutrons
1. Hydrogen	H					
2. Barium	Ba					
3. Magnesium	Mg					
4. Calcium	Ca					
5. Carbon	C					
6. Iron	Fe					
7. Aluminum	Al					
8. Potassium	K					
9. Copper	Cu					
10. Chlorine	Cl					

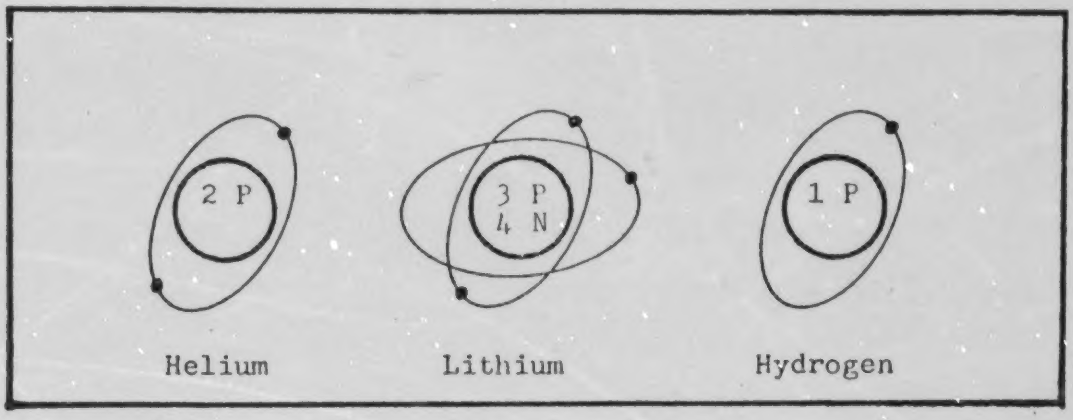
DO NOT WRITE ON THIS SHEET - Unless told to do so, please.

"IN ORBIT"

DIRECTIONS: Read the information below, then complete activity 9.

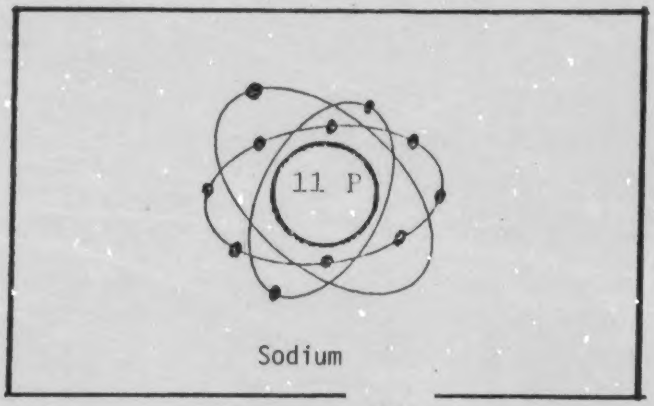
An atom has the same number of electrons in its orbits, or shells, as it has protons. The orbits are labelled K, L, M... or 1, 2, 3... Except for hydrogen and helium, all atoms have 2 or more orbits. The number of orbits an atom has depends upon the number of electrons.

The K shell can hold no more than 2 electrons. The L shell can hold no more than 8 electrons. The outermost energy level or orbit can hold no more than 8 electrons. Here is a diagram of 3 atoms.



Hydrogen, whose atomic number is one, has one electron in the K shell; the K shell is not filled.

Helium, whose atomic number is 2, has 2 electrons in the K shell, and the K shell is filled. Lithium has an atomic number of 3. It has three protons and three electrons. Since the K orbit is filled with two electrons, the third electron must go on the second orbit or the L shell. Electrons must go on the second orbit of the L shell. Electrons can be continually added until the L shell has 8 electrons. The atom that has 8 electrons in the L orbit is neon. Its atomic number is 10. Sodium has an atomic number of 11 so it will have 2 electrons in the K shell, 8 electrons in the L shell, and 1 electron in the M shell. Electrons can be added to the M shell until it has 8 electrons. What element would have 8 electrons on the third shell?



IT DOES MATTER!

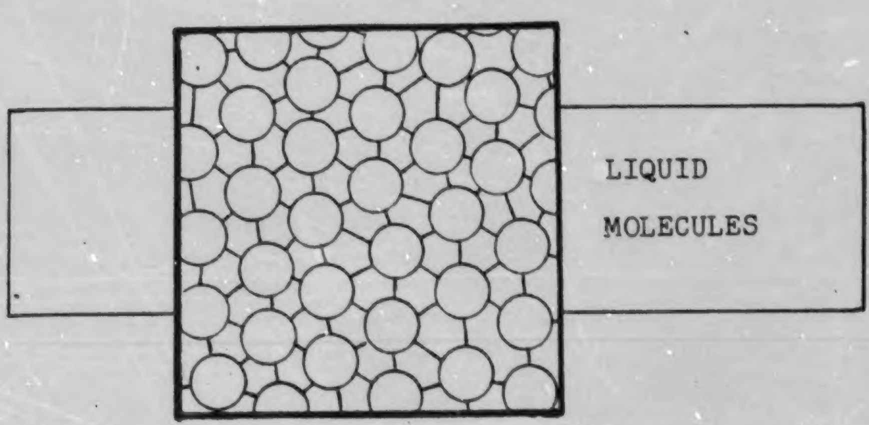
ACTIVITY 6

"IT FLOWS, TOO"

DIRECTIONS: Read the information below and answer the questions that follow. You must answer at least four questions correctly before going to the next activity.

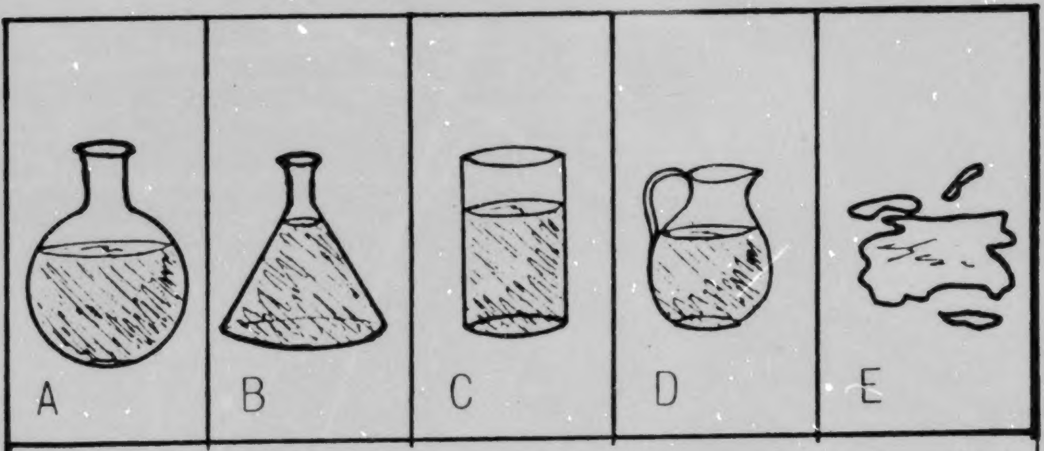
You are probably very familiar with matter in its liquid state. You probably can name many liquids such as alcohol, gasoline, oil and milk. Liquids are in between gases and solids and often show properties of both. They move about as much as gases and flow almost as easily as gases. Their shape is as hard to distinguish as that of a gas. On the other hand, they do retain a shape like a solid when placed in a container, and they have a definable size which cannot be changed.

Why do liquids behave this way? In a liquid, molecules are free to move about, but they remain in contact with each other. If these molecules were not free to move, liquids would not flow. Molecules in a liquid are almost as close as those in a solid, yet they are in constant motion like the molecules of a gas. The effect is like the movement of small ball bearings--rolling and slipping around each other, but still remaining in contact.



The closer the molecules in a liquid are to each other, the slower the liquid will flow.

Liquids have no definite shape, and therefore take the shape of the container but they will not spread or increase their volume to fill the container. Each of the containers below contain one quart of milk. Though containers may be larger or smaller than one quart, the amount of milk will not change. What will change? The shape of the liquid will change when placed in a different shaped container. If the milk stays in container B, it will keep the shape of that container.



--- LIQUIDS TAKE THE SHAPE OF THEIR CONTAINER -----

So, liquids have no definite shape, but they do take up a definite amount of space.

QUESTIONS

1. How are liquids like gases?

2. How are liquids like solids?

3. Liquids have no definite shape, but will retain a shape when placed in a container. Explain this statement.

4. How are the molecules in a liquid arranged?

5. Why do some liquids flow slower than others?

6. Can one quart of a liquid spread to fill a gallon container? Explain your answer.

IT DOES MATTER!

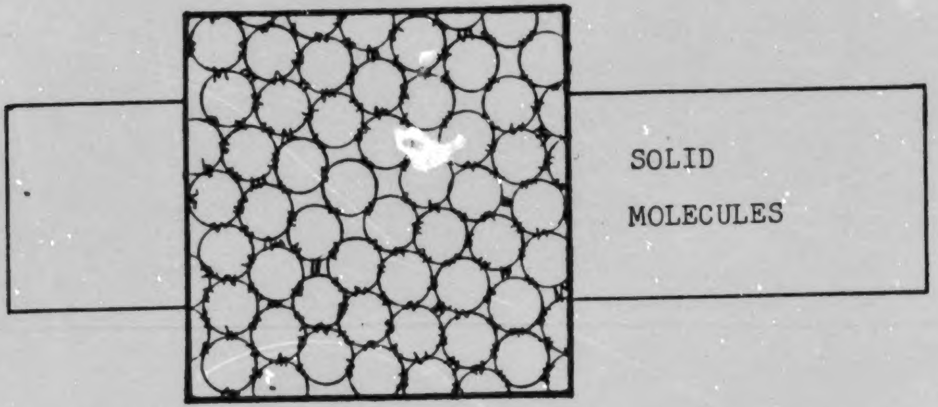
ACTIVITY 8

"IT'S SOLID"

DIRECTIONS: Read the information below and answer the questions that follow. You must answer each question correctly before going to the next activity.

Another state of matter is a solid. Solids take up space and have weight (mass) like the other states of matter. Solids are probably the most familiar and the most abundant form of matter. Unlike a gas, a solid makes its presence plain, and unlike a liquid, a solid stays in one place. It is firm, compact and more easily handled than the other states. Solids have a definite shape (unlike liquids and gases) and take up a definite amount of space (unlike gases).

The reason solids have these properties is because of their structure. The arrangement and the closeness of the molecules in a solid are different from that of a gas or liquid. The molecules, though not free to move from place to place, do vibrate. They are held together in one place because of a strong attraction between each other. This fixed pattern of molecules and strong force of attraction keeps a solid from flowing. It also is the reason why a solid has a definite shape and takes up a definite amount of space.



QUESTIONS:

1. How can a solid be distinguished from a liquid or gas?
2. Do the modecules in a solid have any motion? Explain your answer.
3. Why are the molecules in a solid held together in one place?
4. Why do solids have a definite shape?

IT DOES MATTER!

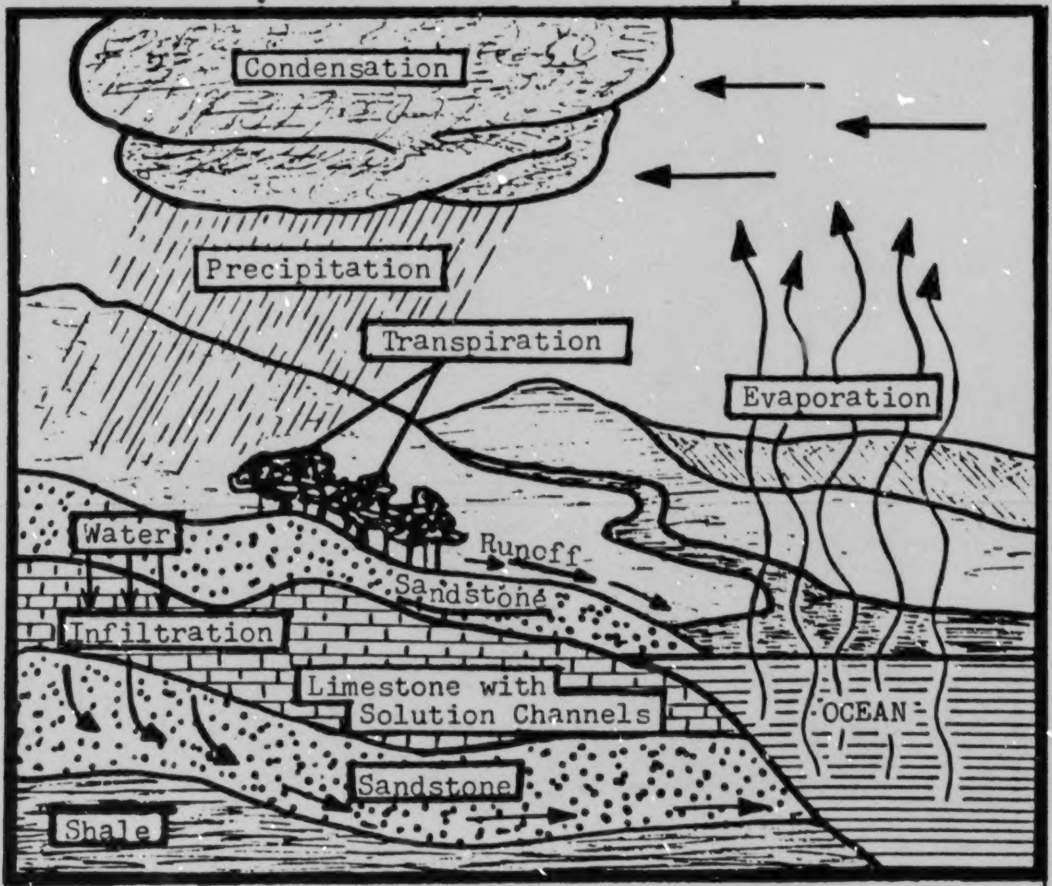
ACTIVITY 10

"IT'S A SOLID, LIQUID, AND A GAS"

DIRECTIONS: Read the information below and answer the questions that follow. You must answer at least 6 of the questions correctly before going to the next activity.

Matter can change from one state into another at certain temperatures and pressure. You already are familiar with water and its three states. At room temperature water is a liquid. At temperatures below freezing, water becomes a solid known as ice. When liquid water or ice is heated it changes to a gas known as water vapor. This process is called evaporation. The steam you see rising from boiling water is water vapor.

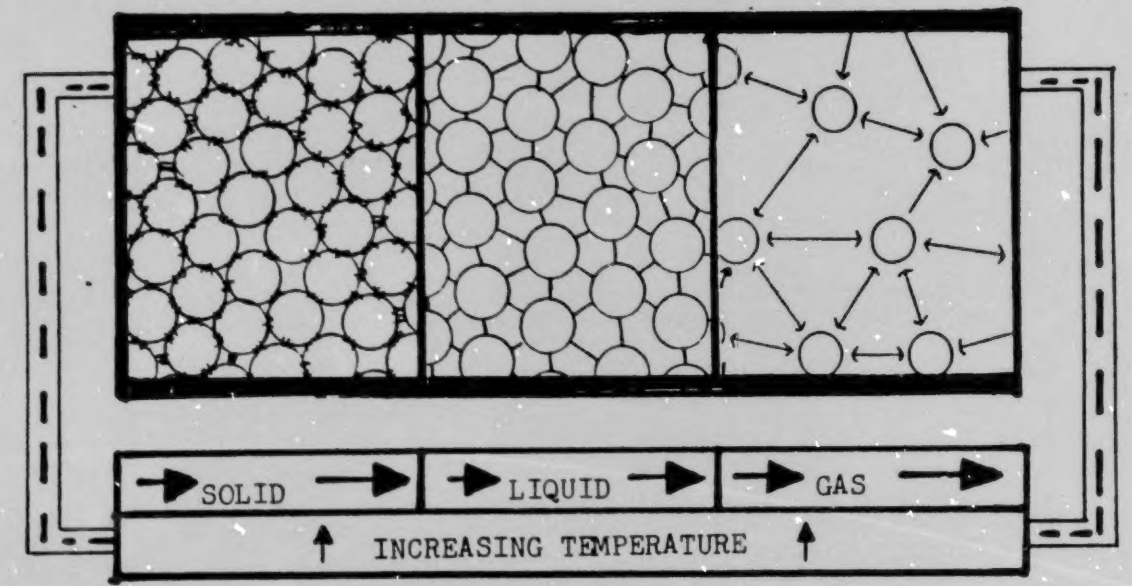
Clouds are formed from water vapor. When the water from oceans, lakes, and rivers is heated by the sun, it evaporates and changes to tiny droplets of water and forms clouds. If this cooling or condensing process continues, the clouds become filled with water and will give rain which returns to oceans, and streams. This cycle continues on and on. It is called the water cycle.

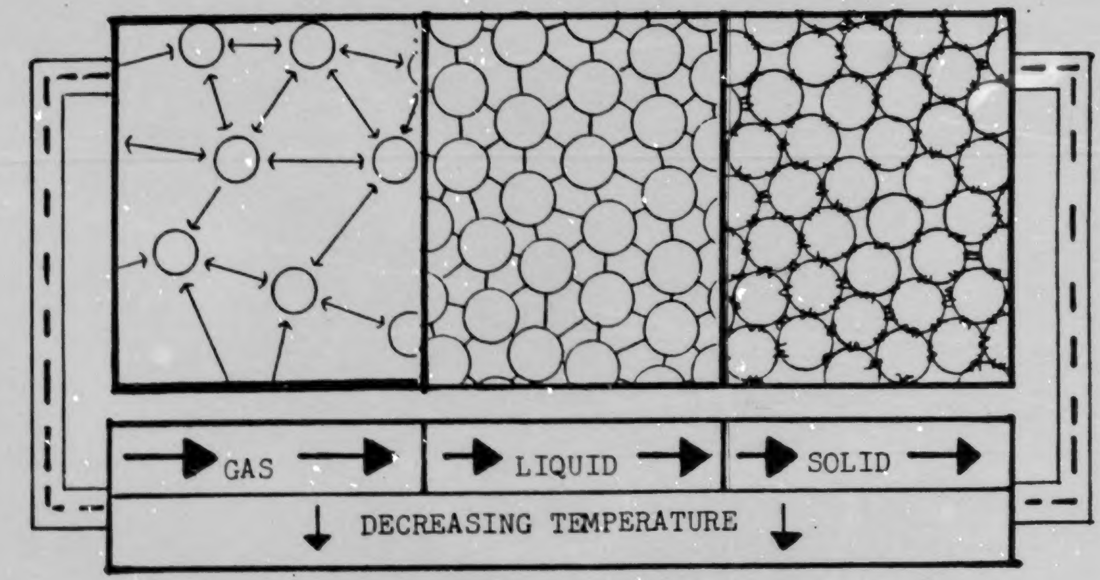

Condensation
Precipitation
Transpiration
Evaporation
Water
Runoff
Sandstone
Infiltration
Limestone with Solution Channels
OCEAN
Sandstone
Shale

- - - - WATER CYCLE - - - - -

By lowering the temperature of water, the water becomes a solid, and by raising the temperature the water becomes a gas (water vapor). When the temperature of that gas is lowered, the gas changes to a solid or liquid. If you raise the temperature of the solid (ice), you change the matter to a liquid or a gas.

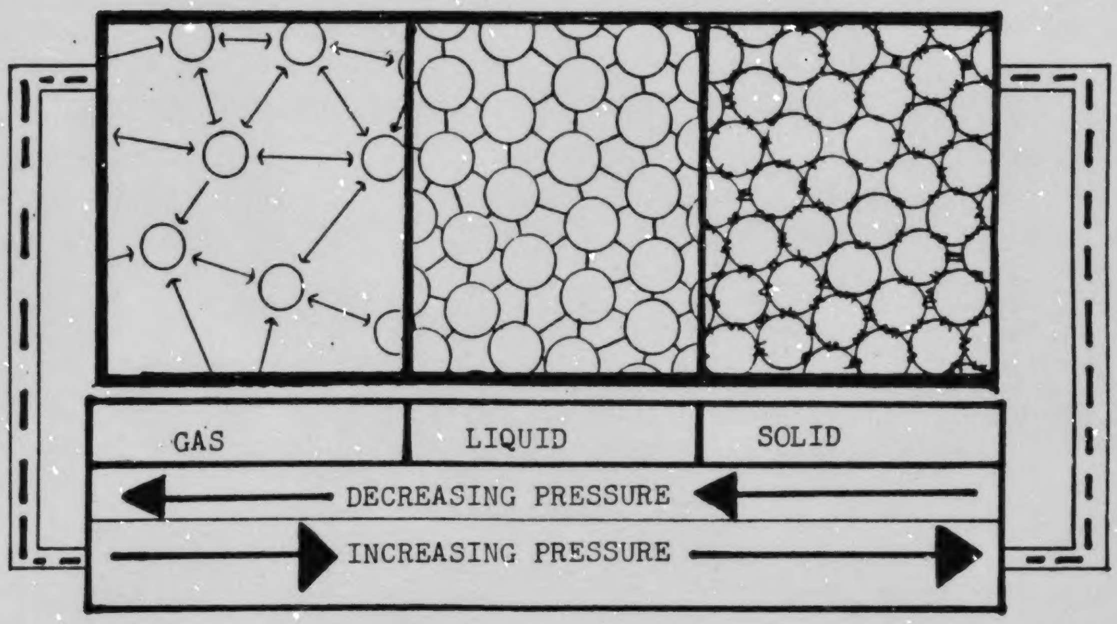
When temperatures fall, molecules slow down. The reduced speed causes molecules to come in contact with each other, and the gas becomes a liquid. Liquids become solids as molecules move more and more slowly. These molecules travel so slowly that they cannot overcome the attraction between other molecules.


SOLID
LIQUID
GAS
INCREASING TEMPERATURE


GAS
LIQUID
SOLID
DECREASING TEMPERATURE

As the pressure on matter increases, molecules are forced into closer and closer contact until eventually they vibrate only around a fixed point. Gases become liquids, and liquid becomes solids.

Depending upon the temperature, molecules may be free to move as pressure decreases. Solids become liquids, and liquids become gases.


GAS
LIQUID
SOLID
DECREASING PRESSURE
INCREASING PRESSURE

IT DOES MATTER!

ACTIVITY 10

QUESTIONS

DIRECTIONS: Complete the sentences using the choices below. An answer may be used more than once.

further
liquid
gas
water vapor
solid
slower
faster
closer

1. If a liquid becomes cold enough, it changes to a ______________________.
2. If a solid becomes hot enough, it changes to a ______________________.
3. Water in the gas state is called ______________________.
4. When a gas cools, it may change to a ______________________.
5. When a gas cools, the molecules move ______________________.
6. When a solid is heated the molecules move ____________________.
7. The greater the pressure, the ____________________ the molecules are to each other.
8. The lesser the pressure, the ____________________ the molecules are to each other.

CHAPTER 5: MINERALS

(Time Allotment: 5 days - One Semester)
10 days - Two Semesters)

Major Concepts to be Taught

Characteristics and properties of a mineral
The properties of crystals
Characteristics used in identifying minerals

Essential Learner Outcomes

- Name three substances obtained in commercial quantities from the earth that are found within 100 miles of Houston.
- Given samples or pictures with obvious characteristics such as gold, silver, mercury, copper, limestone, sandstone, marble, granite, diamonds, rubies, emeralds, quartz, obsidian, talc, sulfur, galena, iron pyrite, halite, etc., identify at least ten different rocks and minerals.

Instructional Objectives

The student should be able to

B . List and explain the five characteristics of a mineral.
. Explain how crystals are formed, describe the six crystal patterns, and recognize any obvious crystalline structures.
e . Name, explain the purpose, and use the standard tests for identifying minerals.

Assessment Guidelines

The student will

- List the five characteristics of a mineral and give a simple explanation of each.
- Name the two most abundant elements.
- Name the main elements in the silicates, carbonates, and oxides.
- Define four of these terms:
  - lithosphere
  - mineral
  - rock formers
  - rocks
  - inorganic
  - crystals
  - mineralogists

e . List five of the seven physical properties of minerals.
. Name all of the body senses that can be used to identify minerals.
. Explain why and how these tools are u

- Give a unique characteristic for each of these minerals:
  - magnetite (naturally magnetic)
  - sulfur (odor)
  - halite (taste)
  - calcite (reacts to HCl)

- Explain how to tell the difference between pyrite (fool's gold) and

Materials

Textbook: Focus on Earth Science, pages 63-91

Earth Science Skillcards:
- No. 32--Minerals--Specific Gravity
- No. 33--Minerals--Crystals, Part I
- No. 34--Minerals--Crystals, Part II
  (use in conjunction with experiment and activity)
- No. 35--Minerals--Cleavage
- No. 37--Minerals--Streak

Lab Manual: "Earth Science--A Learning Strategy for the Laboratory"
- No. 15 - Crystal Formation
- No. 16 - Minerals and Optional Crystallography

Earth Science Activity-Centered Program, Teacher's Guide

- Page 24 - Extensions to the Activity
- Page 24 - Teacher Demonstration
- Page 27 - Additional Activity
- Page 29 - Extension to the Activity
- Page 31 - Extension to the Activity
- Page 32 - Extension to the Activity

Focus on Earth Science Review and Reinforcement Guide

- 5:1 Organizing the Rock-forming Minerals, page 29
- 5:2 Mineral Groups, page 30
- 5:3 Mineral Puzzles, page 31
- 5:4 Identifying Properties, page 32

Additional Suggestions:
- A, B, C, pages 99-101
- Points to Remember, page 99
- Words to Use, page 99
- How and Why, page 101
- More Ideas to Explore, page 181
- Individual mineral collections could be started by students
- Field trip to Museum of Natural Science to review mineral display
- Larkin Lapidary (HOUSTON TOURS FOR CHILDREN AND OTHER PEOPLE, Ebenezer Press)

Film:

M5998--Considering Crystals (1970) 16 min.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	
List and explain the five characteristics of a mineral.	Introduce this chapter by displaying a variety of rock and mineral samples as well as pictures of various rocks. Have students observe them.
	Have students list 30 items made from rocks and minerals that they use daily. Discuss the importance of rocks and minerals in their everyday lives.
	Students could write the definition of a mineral in their notebooks.
	Have students do the activity on Skillcard No. 32--Specific Gravity. Students will learn how to determine the specific gravity of a mineral. Or, have students do "The Specific Gravity of a Solid."
	Have students do Exercise 512 - Mineral Groups. The strategy for this activity is to let the student's study the chemical formulas for several important minerals, identify the elements present, and classify the minerals as silicates, carbonates, and oxides.
	*Hand out copies of these activities: "Rocks and Minerals are Related," and "Sparkling Stones." Have students do these activities. "Sparkling Stones" is a library investigation.
Explain how crystals are formed. Describe the six crystal patterns, and recognize any obvious crystalline structure.	Have students do the activity 2.1 on page 83. In this activity, students will determine two physical processes form crystals.
	Have students make different types of crystals from solutions and examine the crystal shapes. Give students copies of the procedure. This activity will take several days.
	Use Skillcard No. 34 - Crystals, Part II, and have students grow salt crystals and watch the cooling process.
	Have student make salt crystals and compare the structure with sugar crystals.
	Lab No. 12 - "Crystal Formation." Students will "grow" crystals of metallic compounds and observe any reactions.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	These activities in the Review Guide could be done: a. Teacher demonstration on page 24. This project takes several weeks. @ b. Additional Activity on page 27. Students could analyze a set of known crystals by doing Lab 16 - Minerals and Optical Crystallography. In the Record Book Exploring Earth Science by Allyn and Bacon, there are four crystal pattern shapes that students may enjoy putting together. Display these crystal shapes along with minerals having the same pattern. Larkin Lapidary (see Houston Tours for Children and Other People, Ebenezer Press, Houston, Copyright, 1972.) Have a jeweler visit your class to talk about his or her work. Visit the Houston Museum of Natural Science, Students Crystal and Mineral Displays. Before any discussion of mineral identification begins have students do the activity on page 88 of the textbook. This can be a most valuable activity. It is an open-ended activity and can be elaborate or simple. * Students could do exercise 5:1 in the Review Guide, page 29. Have students do exercise 5:4, Identify by Properties on page 32 of the Review Guide.
e Name, explain the purpose, and use the standard tests for identifying minerals.	e Have students list the characteristics they should be aware of when identifying a mineral. Have students do the following activities: a. Skillcard No. 35 - Cleavage. Students will find the cleavage direction of some minerals. b. Skillcard No. 36 - Hardness. Students will determine the relative hardness of some minerals. c. Skillcard No. 37 - Streak. Students will determine the steak of some minerals. Hand out copies of "Identifying Minerals" along with a copy of the "Mineral Identification" chart.

ACTIVITY 7

"SPARKLING STONES"

DIRECTIONS: Write at least two accurate paragraphs on eight of the precious minerals listed below. List the substances (elements) that make up the minerals, tell how it is mined, describe its beauty and then explain why the mineral is so valuable. Some resources appear after the list. They should be available in your classroom or the library. After you submit your reports continue on to Activity 8.

1. diamond
2. ruby
3. emerald
4. sapphire
5. jade
6. cat's-eye
7. opal
8. garnet
9. gold
10. silver

For background information you should read:

Bishop, Margaret, et al. Focus on Earth Science, Second Edition, (Charles E. Merrill Publishing Co. 1972), pages 149-150.

Hibb, Albert and Eiss, Albert. Earth-Space Sciences (Laidlaw Brothers, 1970), pages 455-457.

Pough, Frederick. The Story of Gems and Semiprecious Stones (Harvey House, Inc., 1969.)

Arem, Joel. Rocks and Minerals (Grosset and Dunlap, 1973.)

Bishop, Margaret, et al. Focus on Earth Science, Second Edition, (Charles E. Merrill Publishing Co., 1972), pages 149-150.

GROWING CRYSTALS

Purpose: To grow some crystals with different shapes.

Materials:

several beakers
pencils
long pipe cleaners
spoons
hot plate
pan
oven mitt

table salt (sodium chloride)
copper sulfate (powdered)
sugar
alum (potassium aluminum sulfate)
calcium chloride
borax (sodium borate)
epsom salt (magnesium sulfate)

Procedure:

- Fill the pan with water and heat on the hot plate.
- Fill each beaker about two-thirds full of hot water and add a different compound to each beaker until no more will dissolve in the water. Label each beaker.
- Hold the pencil horizontally and hook the pipe cleaner to the pencil so that most of the pipe cleaner will hang vertically. Lay the pencil on top of the beaker so that the pipe cleaner extends into the solution. Do this with each beaker.
- Set the beakers where they will not be disturbed. Observe them for several days.
- Examine the crystals and observe their different shapes.

Results and Conclusion:

Did crystals form in each beaker?

Of crystals formed, where did they form?

Did all crystals grow at the same rate?

ACTIVITY 3

"ROCKS AND MINERALS ARE RELATED"

DIRECTIONS: Read the information below and study it carefully. Answer the questions on the worksheet that follows.

Minerals are substances that are solid, naturally occurring, non-living, and appear in the crystal shape. A mineral may be either an element or a compound. Some minerals are pure elements such as gold, silver, copper and sulfur. Most minerals in the earth's crust are found combined with other minerals.

A rock may be made of one mineral or of a combination of different minerals. Because there are hundreds of different minerals and many ways for them to combine, there are many different kinds of rocks. Certain rocks are made up mainly of one mineral. Some rocks or parts of rocks were once organic materials, such as plant and animal remains. Over thousands or millions of years these organic materials have turned to rock. Examples of rocks are granite, rock salt, basalt and marble.

Certain minerals are more abundant in rocks than others. These minerals are called rock-forming minerals. Some rock-forming minerals are quartz, feldspar, mica, olivine and amphibole.

ACTIVITY 3

"ROCKS AND MINERALS ARE RELATED"

WORKSHEET

DIRECTIONS: A. Complete the statements below on your own paper. You must complete all these statements before continuing with the rest of this worksheet.

1. Four characteristics of a mineral are the following:

   a. ______________________________

   b. ______________________________

   c. ______________________________

   d. ______________________________

2. A mineral may be either a ______________________ or a ______________________.

3. ______________ and ______________ are examples of minerals.

4. ______________ and ______________ are examples of rocks.

5. Rocks are made or ______________________.

DIRECTIONS: B. Study the chart on next page and determine which substances are minerals. Then answer in your notebook the questions thate follow.

MATERIAL	FOUND IN NATURE	MAN-MADE	COMPOSITION		STATE	
			ORGANIC	INORGANIC	SOLID	LIQUID
1. copper	x			x	x	
2. concrete		x		x	x	
3. diamond	x	x		x	x	
4. glass		x		x	x	
5. mercury	x			x		x
6. plastic		x	x	x	x	
7. steel		x		x	x	
8. rock	x		x	x	x	
9. water	x			x		x
10. wood	x		x		x	

ACTIVITY 3

"ROCKS AND MINERALS ARE RELATED"

WORKSHEET

1. List all the materials that are minerals.
2. Which material is found in nature and can also be man-made.
3. Which material may be organic or inorganic?

NAME________________________________ Period____________________ Date______________

Experiment _______: Identifying Minerals

Purpose: To learn how to identify minerals

Materials: (per table)
streak plates
bar magnet
nail
penny
10 different minerals

Chemical: hydrochloric acid

Procedure One:

1. Record the name of the minerals on the data table.
2. Observe each mineral and record the color and luster on the data table.
3. Using the streak place, record the color marked by each specimen on one data table.
4. Using the Field Scale of hardness method, record the hardness of each mineral on the data table.
5. Observe and record the breakage of each mineral on the data table.
6. Test each specimen with a magnet and record the results on the data table.

Observations:

1. What is the hardest mineral?
2. Which mineral or minerals is (are) attracted to a magnet?
3. List the ones which have a fracture breakage.
4. List the ones which have a cleavage breakage.
5. What is the softest mineral?

Procedure Two:

Select one specimen and perform the "fizz" test.

Observations:

6. What happened to the specimen you selected for the "fizz" test? Explain why you did or did not have a reaction.

Optional procedure:

Determine the specific gravity of each mineral. Record answer on the data table.

Conclusions:

1. How can we tell the difference between marble and gypsum, even though they work alike.
2. What minerals are effervescent?
3. Why do we have this effervescence?

MINERAL IDENTIFICATION

			Luster										
No.	Name	Description	Metallic	Glassy	Waxy	Greasy	Pearly	Dull	Streak Color	Hardness	Breakage	Magnet	Optional Specific Gravity
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													

NAME____ Period____________________ Date_______________

Experiment: ________: The Specific Gravity of a Solid

Purpose: To find the specific gravity of a solid substance.

Material:
250 g spring balance
a container of water
a piece of string (about 50 cm long)

Minerals (Rocks):

Bauxite	Plagioclase
Florite	Hematite
Galena	Chalcopyrite
Halite	Talc

Introduction: The specific gravity of a solid can be found by the formula below, which is an application of Archimedes Principle. The loss of weight of a submerged object equals the weight of the displaced water.

Specific gravity (Sp. gr.)

$$\text{Solid} = \frac{\text{Weight of solid in air}}{\text{Loss of weight of solid in water}}$$

Procedure:

1. Using the piece of string, tie a loop around a sample of rock and suspend the other end from the spring balance.
2. Record the weight of the rock on the data table.
3. Lower the rock into the container of water.
4. Record the weight of the rock in water on the data table.
5. Complete the data table.

Data Table:

MINERAL	WT.IN AIR	WT. IN WATER	LOSS OF WT.	YOUR SP.GR.	CORRECT SP.GR.	DIFFERENCE
BAUXITE						
FLORITE						
GALENA						
HALITE						
PLAGIOCLASE						
HEMATITE						
PLAGIOCLASE						
TALC						

BEST COPY AVAILABLE

Guide Questions:

1. Which mineral has the least loss of weight in water? Tell why?
2. Which mineral has the greatest loss of weight in water? Support your answer.
3. Define the term specific gravity.

Conclusion:

1. A specimen weighs 20 grams in air and 17 grams in water. What is its specific gravity?
2. Having this knowledge, what is its relationship to water?

CHAPTER 6: HIGH TEMPERATURE AND PRESSURE ROCKS

(Time Allotment: 3 days - One Semester)
6 days - Two Semesters)

Major Concepts to be Taught

The formation of igneous rocks is controlled by heat and pressure.
Igneous rock formations vary in size and shape.
Igneous rocks are classified according to texture and composition.
Heat and great pressure cause metamorphism.
The classification and identification of metamorphic rocks

Essential Learner Outcomes

The student will -

- Name three substances obtained in commercial quantities from the earth that are found within 100 miles of Houston.
- Given samples or pictures with obvius characteristics, such as gold, silver, mercury, copper, limestone, sandstone, marble, talc, sulfur, galena, iron pyrite, halite, etc., identify at least ten different rocks and minerals.

Instructional Objectives

The student should be able to:

B . Interpret the rock cycle from a diagram.

B . Describe how igneous rocks are formed and the sources of heat and pressure by which magna forms.

e . Compare the formation of extrusive and intrusive igneous rock and identify at least two rocks of each type.

B . Describe at least three mineral families and determine their order of crystallization.

. Discuss the conditions needed for metamorphic rocks to form.

e . Define foliated and nonfoliated and identify rocks of these classifications.

Assessment Guidelines

The student will -

- Name the three rock groups into which all rocks are classified.

. Use the words igneous, sedimentary, or metamorphic to identify these characteristics:

the parent rock
means "transform" or "change in form"
the most abundant type of rock
made of small weathered particles under great pressure
formed by great heat and pressure deep below the surface

. Explain the differences between lava and magna.

. Use either intrusive or extrusive to complete these statements:
_________________ rocks cool on or near the earth's crust.
_________________ rocks cool within the earth's crust.
_________________ rocks cool rather slowly.
_________________ rocks have large crystals.
_________________ rocks have small crystals or no crystals.

. Tell how to easily identify pumice.

. Explain why scoria and pumice have holes and microscopic crystal structure.

e . Identify from a collection of igneous rocks, three of these rocks:

granite
basalt
scoria
obsidian
pumice
gabbro
diorite
peridotite
felsite

e . Classify these rocks as either intrusive or extrusive:

granite
basalt
pumice
obsidian
diorite

. Name the two factors responsible for the formation of metamorphic rocks.

. Define foliated and give an example of a foliated rock.

e . Identify from a metamorphic rock collection four of these rocks and classify them as either foliated or nonfoliated:

slate
gneiss
marble
quartzite
serpentine
schists

e . When given a list of fifteen rocks, categorize each according to pure mineral, igneous, metamorphic.

Pure mineral	Igneous	Metamorphic
sulfur	granite	slate
calcite	basalt	gneiss
quartz	pumice	marble
feldspar	obsidian	

- When given five common metamorphic rocks indicate those that are igneous in origin and separate them from those that are sedimentary in origin.

Materials: Textbook: Focus on Earth Science, pages 102-121

Earth Science Skillcards:
No. 43 - Rocks--Igneous, Granite
No. 44 - Rocks--Igneous, Obsidian
No. 45 - Igneous, Pumice
No. 27 - Earth's Crust - Pressure for section 7:1 page 127
No. 42 - Rocks - Metamorphic, Marble for section 7:6, page 133

Lab Manual: "Earth Science--A Learning Strategy for the Laboratory"
No. 17 - Gas Production in Magma
No. 18 - The Effect of Magma on the Surrounding Rock
No. 19 - Metamorphic Processes

Earth Science Activity-Centered Program - Teacher's Guide
Page 33, Additional Activity for page 103
Page 35, Extension to activity
Page 35, Additional Activity for page 105
Page 39, Extension to Activity 6-1
Page 40, Extension to Activity 6-2

Focus on Earth Science Review and Reinforcement Guide
6:1 - The Rock Cycle, page 33
6:2 - Classifying Igneous Rocks, page 34
6:3 - Changing from Heat and Pressure, page 35
6:4 - Igneous and Metamorphic Rock Puzzles

Additional Suggestions:
- A, B, C, pages 119-121
- Points to Remember, page 119
- Words to Use, page 119
- How and Why, page 121
- More Ideas to Explore, page 121
- Individual rock collection
- Field Trip to Llano Region, Texas

Film:
M2898 - Igneous Rocks

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	
Interpret the rock cycle from a diagram.	Students could write in their notebooks the names of the three rock groups and explain how each group is formed.
	Display a few common rocks of each group and label them as to their group.
	Have students do the Exercise on page 33 in the Review Book.
	Have students draw the rock cycle diagram in their notebooks. They should leave space for entering the names of rocks as they learn them.
	Students could make a bulletin board on the rock cycle (page 104--figure 6-1). If rocks and pictures are used, they may be able to understand the concept better and more quickly.
Describe how igneous rocks are formed and the sources of heat and pressure by which magma forms.	Observe various products made from rocks and minerals and make a list of these products. Decide which products are made within a 100 mile radius of Houston.
	Have students do Lab No. 18 - The Effect of Magma on Surrounding Rock. The activity shows the effect of magma on solid rock (time factor - 4 days).
	Have students do Lab No. 17 on page 30 of the Lab Manual. Students will observe the effect of gas on solids within magma.
	Have students make their own model igneous rocks. Hand out copies of "Cool It." This activity demonstrates how magma cools to form igneous rocks.
e Compare the formation of extrusive and intrusive igneous rocks and identify at least two rocks of each type.	Have the students to Lab No. 16 - Stretching It. Students will make taffy and observe the texture.
	Have the students observe the crystal formations in fudge by doing the activity on page 97. This activity could be done at home.
	Have the students do the experiment on page 97. This activity compares rising bread dough to pumice and scoria.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Let the students look at igneous rocks of varying textures. They should see granite of various crystal sizes, basalt, obsidian, pumice or scoria, gabbro and diorite. Make a list of their similarities and differences, then classify these rocks as either intrusive or extrusive.
	Students could make a table or chart showing what might be a good way to identify igneous rocks described in this section.
	The following activities will help the students identify granite, obsidian, and pumice: a. Skillcard No. 43 - Igneous, Granite b. Skillcard No. 44 - Igneous, Obsidian c. Skillcard No. 45 - Igneous, Pumice
	Have students do the activity on page 111. This activity has the students identify igneous rocks and classify them as to intrusive or extrusive.
	Do Classifying Igneous Rocks, Exercise 6:2, page 34 of Review Guide.
	@ Have students construct a map of Houston depicting the kinds of rocks found.
Describe at least three mineral families and determine their order of crystallization.	Have students read Section 6:3 and 6:4 on pages 105-111.
	Have a class discussion on the composition of igneous rocks. Point out the influence of the order of crystallization on composition.
	Study Table 6-1 on page 107 and determine which minerals are the last to crystallize.
	Have students compare Table 6-1 with Table 6-2 on page 109 to determine which order the following igneous rocks crystallize: granite, peridotite, basalt, and diorite.
	Have students determine which rocks in Table 2, page 109, are extrusive and which are intrusive.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	
	Make a display of the mineral families found in igneous rock. Then have students observe igneous rocks from each family.
	Have students identify diorite, gabbro, granite, obsidian, basalt, scoria, pumice, and peridotite.
Discuss the conditions needed for metamorphic rocks to form.	Have students do the activity on Skillcard No. 27 - Pressure. This activity demonstrates the effect of increased pressure on melting.
	Have students do Lab No. 19 - Metamorphic Processes. This activity demonstrates the relationship between rise in pressure and rise in temperature. This activity requires a hand bicycle pump.
	Students should do the activity on page 114. This activity demonstrates metamorphic change due to pressure.
	Emphasize the fact that metamorphism is a chemical process as well as a physical process at high temperatures. Discuss the processes as explained in Section 6:5, page 54T of Teacher's Annotated Edition.
	Students could do Exercise 6:3 - Changes From Heat and Pressure, page 35, of the Review Guide.
e Define foliated and unfoliated. Identify rocks of these classification.	Define foliated and unfoliated and give examples for both groups.
	Have students do the activity on Skillcard No. 42 - Metamorphic, Marble. This activity shows how to identify marble (nonfoliated).
	Have students observe slate, schists and gneiss and describe how these rocks differ from the nonfoliated rocks of marble, quartzite, and serpentine.
	Have students make a classification chart. See page 116 for details.
	Have students do Activity 6-4, page 117. In this activity students will classify metamorphic rocks.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Obtain a geologic map of Texas and have students determine if any metamorphic rocks are present and color in the area on an outline map. Have students read Focus on Careers, page 118. Have students prepare a report on the quarrying of marble, limestone, slate, or granite.

COOL IT

Purpose: To demonstrate how magma cools to form igneous rock.

Materials:

- hammer
- mothballs
- crayon
- test tubes
- corks
- hot plate
- beaker
- pan
- sand
- ice
- masking tape
- towel
- microscope
- magnifying glass

Procedure:

- Put two mothballs in each of three test tubes. If the mothballs will not fit, crush six mothballs with a hammer and put one third of the pieces into each of the test tubes.
- Divide a crayon into three equal pieces and put one piece into each of the test tubes.
- Stand the test tubes in a beaker of boiling water until the mixture melts.
- Seal each of the test tubes with a cork.
- Put one test tube in cold water or ice to cool.
- Push the second test tube into a pan of dry sand to cool.
- Leave the third test tube in the beaker to cool as the water cools.
- Label each test tube as to where it was cooled.
- When the solution has completely hardened, wrap each test tube in a towel and tap it with a hammer until the glass breaks.
- Remove the glass and examine the "rocks" you have made with a magnifying glass and under low-power of the microscope.

Results and Conclusions:

1. Describe the size of crystals in each "rock."
2. What can you say about crystal size and the speed of cooling of the "rock."

EFFECT OF CHANGES IN TEMPERATURE ON ROCKS

Problem: What happens to rock that undergoes sudden changes in temperature?

Materials:
hand lens
burner
matches
pail
rock
tongs
safety goggles

Procedure:

1. Examine your rock with a hand lens. Notice if the surface of the rock is smooth or if it is pitted or scratched.
2. Fill a pail with cold water. Set the pail to one side of the burner. Light the burner.
3. Use tongs to hold the rock above the flame of the burner for two or three minutes. If the handle of the tongs is not insulated, you may wish to hold the tongs with a hot pad or thick glove to protect your hand from heat. Then drop the rock into the cold water. Caution: Wear safety goggles and do not lean over the pail as you drop the rock into it.
4. Let the rock cool in the water for several minutes. Then use the tongs to remove the rock from the pail of water. Use a hand lens to examine the surface of the rock. Look for any changes that may have resulted from heating and then suddenly cooling the rock.

Questions:

1. Was the surface of the rock smooth or was it pitted and scratched when you first examined it?
2. Were there any noticeable changes in the surface as you were heating the rock? If so, describe them.
3. What happened when you dropped the hot rock into cold water?
4. What changes in the rock, if any, did you observe after you removed the rock from the water?
5. How might sudden changes in temperature affect rock on the surface of the earth?

CHAPTER 7: WEATHERING AND SEDIMENTARY ROCKS

(Time Allotment: 2 days - One Semester)
6 days - Two Semesters)

Major Concepts to be Taught

The origin of sedimentary rocks
Weathering and products of weathering
Comparison and identification of clastic and nonclastic sedimentary rocks
Features of sedimentary rock

Instructional Objectives

The student should be able to:

B . Give the definition for weathering by disintegration and decomposition and describe each type.
B . Name and identify some of the products of weathering.
e . Distinguish between the formation of clastics and nonclastics, and identify or classify different sedimentary rocks as clastic or nonclastic.
e . Name and describe some characteristic features of sedimentary rocks and be able to use these clues in identifying sedimentary rocks from the other two rock groups.
e . Summarize the study of earth's matter by identifying from a rock collection different minerals, igneous, sedimentary, and metamorphic rocks.

Assessment Guidelines

The student will:

. Explain what sediments are.
. Define weathering and name the two types of weathering.
. Define disintergration and give an example of weathering by disintergration.
. Define decomposition and give an example of weathering by decomposition.
. Name some products of weathering.
. Describe the formation processes of clastics and describe their appearance.
e . Identify from a sedimentary rock display these characteristic features:
    strata
    fossils
    conglomerates
    ripple marks
    geodes
    mud cracks
e . Identify from a collection of sedimentary rocks, three of these rocks:
    limestone
    flint or chert
    sandstone
    coal
    shale
    alabaster
    breccia
    conglomerate

Materials

Textbook: Focus on Earth Science, pages 182-141

Earth Science Skillcards:
- No. 38 - Rocks - Lithification
- No. 39 - Rocks - Sedimentary, Sandstone
- No. 40 - Rocks - Sedimentary, Shale
- No. 41 - Rocks - Sedimentary, Limestone
- No. 46 - Soil From Rocks - Size and Surface Area
- No. 47 - Soil From Rocks - Ice Wedging
- No. 48 - Soil From Rocks - Temperature

Lab Manual: "Earth Science--A Learning Strategy for the Laboratory"
- No. 20 - Chemical Weathering
- No. 21 - Concretions

Earth Science Activity-Centered Program, Teacher's Guide
- Page 46, Extension to Activity, 7-1
- Page 48, Extension to Activity, 7-2
- Page 50, Extension to Activity, 7-3
- Page 53, Extension to Activity, 7-4

Focus on Earth Science Review and Reinforcement Guide
- 7:1 Types of Weathering, page 37
- 7:2 A Closer Look at Sedimentary Rocks
- 7:3 Particle Size and Sedimentary Rocks
- 7:4 Sedimentary Rock Puzzles

Additional Suggestions:
- . A, B, C, pages 139-141
- . Points to Remember, page 139
- . Words to Use, page 139
- . How and Why, page 141
- . More Ideas to Explore, page 141
- . Individual collection on sedimentary rocks

Film:
- M2466 - A Boy's Trip into the Grand Canyon

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Give the definition for weathering by disintegration and decomposition and describe each type.	Define disintegration and decomposition. Have students do the experiment on Skillcard No. 47. This experiment compares the effect of alternate freezing and thawing of water in the opening of a rock. Have students find out what happens when cold rocks are suddenly heated. Students should examine the surfaces of two or three small rocks carefully with a hand lens. Then place the rocks in a freezer for several hours. At the end of that period of time place a pan of water on a stove. Heat the water to boiling. When the water is boiling, remove the rocks from the freezer and drop them into the water. Turn off the flame under the pan and let the water cool. When the water has cooled, remove the rocks from the water and examine them. Have students do the experiment on Skillcard No. 48 - Temperature. This activity shows how sudden changes in heating and cooling cause rocks to break apart (disintegration). Have students do "Effects of Changes in Temperature on Rocks." Hand out copies of this activity. Have students do Lab No. 20 - Chemical Weathering. This lab demonstrates weathering by decomposition. Have students do the experiment on page 125. This experiment also demonstrates weathering by decomposition. Hand out copies of this experiment. Have students list all the evidence of surface change observable on their way to and from school or within their own neighborhoods. Emphasize the importance of climate and the kind of rock in determining the rate and kind of weathering. Some students could do exercise 7:1 Types of Weathering, page 37 of the Review Guide.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Name and identify some of the products of weathering.	Have students do Skillcard No. 46 - Size and Surface Area. Students will try to learn how the exposed surface area and weight of an object is related to the size of its fragments. This could be an interdisciplinary activity with math. Have students list the products of weathering. @ Have students read about the great drought of the 1930's to learn what caused it and what happened to that area since then. Compare desert soils with soils from humid regions. Have students study samples of soil under a magnifying glass. Ask students to look for materials that they recognize. List these components on the chalkboard as they are reported by students.
e Distinguish between the formation of clastics and nonclastics and identify or classify different sedimentary rocks as clastic or nonclastic.	Define clastic and nonclastic. Have students do "Sedimentation." This investigation shows how sorting takes place during sedimentation. Hand out copies of this activity. The activity on page 113 is similar. Have students do the experiment on page 132. This experiment shows what causes fragments of rock to become clastic sedimentary rock. Students could do the experiment on Skillcard No. 38 - Lithification. Students could do "Sediments from Dissolved Chemicals." Students will make sediments from dissolved chemicals. Have students do the following activities: Skillcard No. 39 - Sedimentary, Sandstone. Students will learn how to identify rocks that may be sandstone (clastic). Skillcard No. 40 - Sedimentary, [illegible]e. Students will learn how to identify rocks [illegible] may be shale (clastic).

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Skillcard No. 41 - Sedimentary, Limestone. Students will learn how to identify rocks that may be limestone (nonclastic).
	Determine what causes fragments of rock to become clastic sedimentary rocks by doing Activity 7-2, page 132, Focus on Earth Science. Refer to the Classification Chart for Sedimentary Rocks in Table 7-1, page 133. Suggest rock names for the synthetic rocks.
	Some students could do Activity 7-3, page 135 of textbook.
	Students could also do exercise 7:2, A Closer Look at Sedimentary Rocks and 7:3, Particle Size and Sedimentary Rocks, pages 38-39 in the Review Guide.
Name and describe some characteristic features of sedimentary rocks and be able to use the clues in identifying sedimentary rocks from the other two groups.	Have students do Lab No. 21 - Concretions. The students will make concretion and study the processes by which it was made (time factor - 5 days).
	Have a fossil displaya. Students seem interested in fossils and usually bring their collection for the class.
	@ Students can identify the organisms by reading about them, and finding where they would fit in the geologic time scale.
	Geodes are very popular and interesting. Set up a display, study how they are formed, and have the students decide where and how to look for them on field trips.
	Have students bring to class magazine photos showing strata (Grand Canyon, road cut-outs, etc.) and other rock structures.
	Have students do Activity 7-4, page 137. In this activity, students will test and identify unknown rock specimens.
	Activity 7-4 could be used as an evaluation of student's progress, follow the procedure on page 53 of the Activity Book.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	
e Summarize the study of the lithosphere by identifying from a rock collection different minerals, igneous, sedimentary, and metamorphic rocks.	Have students pair off the following sedimentary and metamorphic rocks and make a list of the similarities and differences you can observe in them: (a) shale and slate, (b) bituminous coal and anthracite, (c) limestone and marble, (d) conglomerate and gneiss, (e) sandstone and quartzite. Have students do the activity on page 135. This activity has the students identify fifteen different rocks and classify them into the three rock groups. Add any additional rocks or minerals of choice. Take the following "field trips" to see how many different kinds of rock the students can identify: (a) to their school building (look at window sills, staircases, and ornamental stone in lobbies, the auditorium, the front of building, etc.); (b) to other public buildings in their neighborhood; (c) to local parks and other outdoor areas; (d) to a monument works or graveyard. Have students do the activity "Examination of Rocks." Hand out copies.

ACIDIC WATER

Problem: Does acidic water in humid climates cause weathering?

Materials:
6 small glass jars
fragments of granite, limestone, basalt, quartz
distilled water
rainwater
5% hydrochloric acid (HCl)

Procedure:

1. Put some fragments of granite, limestone, basalt, and quartz in a jar. Cover with distilled water.
2. In jar 2, put fragments of each rock and cover with rainwater.
3. In jar 3, cover fragments of granite with 5% HCl.
   CAUTION: DO NOT GET ACID ON CLOTHES OR BODY.
4. In jar 4, put fragments of limestone and cover with 5% HCI.
5. In jar 5, put fragments of basalt and cover with 5% HCI.
6. In jar 6, put fragments of quartz and cover with 5% HCl. Label all jars.
7. Record the appearance of the rocks in each jar in your data table. Let the six jars stand overnight. Record any changes in the jars.

Results and Conclusions:

1. Did any of the rocks change?
2. What is the importance of rainwater? How can you test rainwater to see if it is an acid?
3. What common rock is weathered by acid? Would rainwater be acidic enough to weather this rock?
4. Would underground water do greater weathering? Explain.
5. Why would weathering in humid climates be more acid than in other climates?

SEDIMENTATION

Problem: How does sorting take place during sedimentation.

Materials:

500 millimeter jar with a lid	coarse-grain sand
metric ruler	fine-grain sand
water	coarse gravel
garden soil	fine gravel

Procedure:

1. Add the sediments one at a time to the jar so that each layer of sediment is about two centimeters deep. Add enough water to fill the jar about three-quarters full. Cap the jar.
2. In what order do you think the sediments will settle out after the jar is shaken? Use the chart on Sediment Layers to record the order in which you think the sediments will settle under "Predicted Order."
3. Shake the jar vigorously for two to three minutes. Carefully observe the various sediments as they settle out of the water.
4. After all the Sediments have settled out, record the order in which they settle out under "Actual Order" in the chart.

SEDIMENT LAYERS		
Predicted Order	Actual Order	
		Top layer
		Bottom layer

Results and Conclusion:

1. Which sediments settled out first? Which sediments settle out last?
2. In a short paragraph, explain your observations.
3. What can you tell about the way layers are formed in sedimentary rocks?

SEDIMENTS FROM DISSOLVED CHEMICALS

Purpose: To make sediment from dissolved chemicals

Materials:
pie pan
salt
sugar
baking soda
food coloring

Procedure:

1. Use table salt, sugar, baking soda and food coloring to stand for minerals.
2. Dissolve a few grams of each solid in a pan of clean water. Add a drop of food coloring and mix well.
3. Set the solution aside to evaporate overnight.
4. The next day, test the hardness of your mixture.

Results and Conclusion:

1. If your "minerals" had come from the hard part of Earth, could what is left be called rock?
2. How does this activity compare to formation of sedimentary rocks from dissolved sediments?

ACTIVITY: Examination of Rocks

Purpose: To become familiar with the appearance and characteristics of some common types of rocks.

Procedure: Examine each type of rock carefully and make the proper notes to help you identify it to remember the name.

	NAME	GENERAL APPEARANCE	DENSITY HOW HEAVY?	HARDNESS & CLEAVAGE OR FRACTURE	FEEL TEXTURE	OTHER FEATURES
METAMORPHIC	Quartzite					
	Gneiss					
	Gray Slate					
	White Marble					
	Schist (Mica)					
SEDIMENTARY	Conglomerate					
	Red Sandstone					
	Halite					
	Coal Shale					
	Shell Limestone					
IGNEOUS	Obsidian					
	Pumice					
	Basalt					
	Granite					
	Gabbro					

UNIT III

EARTH'S AIR AND WATER

Chapter 8: Air

(Time Allotment: 3 days - One Semester)
5 days - Two Semesters)

Major Concepts to be Taught

The composition and structure of the atmosphere
Heat is transferred from one body to another by various processes
Major air circulation and the Coriolis effect
The characteristics and location of wind systems

Essential Learner Outcomes

The student will -

List at least two conditions that exist on planet earth that enables life as we know it to exist.

Instructional Objectives

The student should be able to

- B Identify and describe the atmosphere according to composition and structure
- Prove that air has volume
- Demonstrate that air has pressure
- e Describe methods of heating the atmosphere
- Explain the cause and effect of air circulation
- Describe the major word systems and explain why they have developed

Assessment Guidelines

- Define atmosphere.
- Tell how far our atmosphere extends both into space and into the earth's crust.
- Define air pressure.
- Name the instrument that measures air pressure and give an exact reading from this instrument.
- e Name the four most abundant gases of the atmosphere.
- Name the most abundant gas of the atmosphere.
- e Identify the two other important substances of the atmosphere other than the gases (water vapor and dust particles).
- Name the five layers of the atmosphere in order from the earth's surface upward.
- Give two characteristics for each layer.

- Define heat.
- e Use a thermometer as an instrument to measure heat.
- Name the three types of heat transfer and give an example of each.
- e Name the most effective method of heating the atmosphere.
- Define any four of these terms: dew, dew point, relative humidity, frost, condensation, evaporation, transpiration.
- Use a world globe and replica of the sun to demonstrate the causes of the seasons.
- Define equinox and solstice.
- Identify the approximate days of June 21st, September 21st, December 21st, March 21st as to solstice and equinox.
- Define climate and temperature.
- Name the force that causes the air currents to be deflected and use a globe to demonstrate this action (page 184).
- Locate on a globe or map the position of these major wind systems: polar, westerly, easterly, doldrums.
- State and explain two causes of wind.
- Explain and compare cyclone and anticyclone.
- Write a short description of the jet stream.

Materials

Textbook: Focus on Earth Science, pages 142-163

Earth Science Skillcards:
- No. 19--Earth in Space--Heat and Light for section 9:5, page 169
- No. 69--Weather--Humidity for Section 9:5, page 170 (problems 5, 6)
- No. 70--Weather--Dew Point for Section 9:5, page 170 (problem 4)
- No. 71--Weather--Barometer for Section 9:2, page 161
- No. 72--Weather--Air Movement

Lab Manual: "Earth Science--A Learning Strategy for the Laboratory"
- No. 22--Air
- No. 23--Air Pressure
- No. 24--Temperature of the Air
- No. 25--Air in Motion
- No. 26--Radiant Energy and Climate

Focus on Earth Science Review and Reinforcement Guide
- 8:1 - Atmospheric Pressure, page 41
- 8:2 - Radiant Energy, page 42
- 8:3 - Heat Transfer, page 43
- 8:4 - Atmospheric Puzzles

Focus on Earth Science Activity-Centered Program, Teaher's Guide
- Page 55 - Extensions to Activity 8-1
- Page 56 - Additional Activity
- Page 58 - Teacher Demonstration
- Page 60 - Extensions to Activity 8-2
- Page 62 - Teacher Demonstrations (Conduction)
- Page 63 - Extensions to Activity 8-4

Additional Suggestions:
- A,B,C, pages 161-163
- Points to Remember, page 161
- Words to Use, page 161
- How and Why, page 163
- More Ideas to Explore, page 163
- Studies on high altitude flights and mountain climbing
- Bulletin board on the structure and composition of the atmosphere
- Focus on People, page 160

Films:
5396--Convection of Heat (1968) 11 min.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	* Have students start collecting weather maps. They will collect maps for two weeks. These will be used to interpret weather maps for Chapter 10.
	Introduce this unit by having students explain the connection among photographs on pages 142-143.
	Have students to read the questions on page 144 and observe the photograph on that page. Tell students that these questions will be answered in the study of Chapter 8.
	Read Focus on People, page 160 of the textbook.
Identify and describe the atmosphere according to composition and structure.	Make a circle graph showing the composition of air by percentages. Discuss the variation in percentages of water vapor, dust and other particles.
	Have students define and spell correctly these words: troposphere, stratosphere, mesosphere, ionosphere, exosphere.
	Have students to write a brief report on the origin and meaning of each name of the layers, who discovered each layer, when each layer was discovered, and how each layer was discovered. Give a 3-minute oral report to the class.
	Make copies of "The Atmosphere" chart. Have students record information to compute this chart.
	Have students to describe where the ozone layer is found and how it is formed.
	Explain how the ozone layer protects living things.
	Describe how the mesosphere protects us from meteors that reach the earth's atmosphere.
	Make a chart of the five layers and list characteristics for each layer, such as type of gases, temperature, location above earth's surface, general condition of layers, how this layer benefits man.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Bulletin board similar to drawing on page 165. Students could fill in each layera with the important facts from sections 9:3 and 9:4. Eighth graders have excellent imaginations and could produce good work on this activity.
	@ Prepare a report on high altitude flights by airplanes or balloons; illustrate with pictures and charts.
	@ Research the conquest of some of the higher mountains. Mention the atmospheric difficulties encountered and methods used to overcome these difficulties.
	Ask students whether any of them have camped in high altitudes where water takes longer to boil, etc. Take samples of prepared baking mixes that give instructions for cooking in higher altitudes. Discuss the reasons for this.
	Invite a "ham radio operator" to talk with the class about differences in reception from stations and explain what is meant by "atmospheric conditions" in relation to radio and TV reception.
	Students could complete exercise 8:1 Atmospheric Gases, page 41 of Review Guide.
Prove that air has volume.	Have students do the activity on page 147. This activity shows that air has volume.
	Hand out copies of "Air." Students could complete this activity, then discuss their observations.
	Lab No. 22, page 49 of the Lab Manual demonstrates that air has volume.
Demonstrate that air has pressure.	Use Skillcard No. 71 - Barometer. Have students make a simple barometer. Have them record daily changes in the weather for two weeks.
	Students can do the activity on page 163. This activity shows that air exerts pressure.
	Demonstrate "Weighing Air" using an empty gallon can. Copies of this activity should be given to the students. Have students record their observations.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Give students copies of "Air Pressure" and demonstrate this experiment. Have students record their observations.
	Have students do the following activities: a. Lab 23 - Air Pressure, page 51 of the Lab Manual b. Activity 8-2, page 150 of the textbook @ c. Record pressure changes for a period of one week. Use the data to construct a line graph. Compare the pressure changes on the line graph with weather changes that have occurred during the week.
Describe methods of heating the atmosphere.	Review the electromagnetic spectum and the properties of waves. See Chapter 23, Section 23:5. Emphasize that the greenhouse effect is the chief mechanism for controlling surface temperature.
	Have students design an experiment to illustrate the greenhouse effect.
	Have students measure the temperature of the air over asphalt, soil, and water surfaces on a sunny day.
	* Skillcard No. 19--Heat and Light. This activity explains why the poles are much colder than the equator.
	List the three methods of heat transfer and give examples for each method.
	Conduct the experiment on pages 172-173. This will help the students to understand the different methods of heat transfer.
	Students could do Lab 24 - Temperature of the Air, page 53 of the Lab Manual. In this activity, students will measure the air temperature at different times during the day and graph the results.
Explain the cause and effect of air circulation.	Observe the movements of air from cooler to warmer places by conducting the activity on Skillcard No. 72 - Air Movement.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Make copies of "Air Moves by Convection" and have students conduct this experiment. Or, you may perform this as a demonstration and have the students record their observations and analyze the results.
	Have students show the action of the coriolis force by doing the activity on of page 157.
Describe the major wind systems and explain why they have developed.	Students can draw and label the wind belts in each hemisphere on an outline map of the world. Have students explain why the easterlies are also called the trade winds. This could also be done for a bulletin board display.
	Research popular sports, such as gliders, hot air balloons, sailing, and kite flying.
	@ Students can explain the theory behind such sports.
	Have students launch some balloons. Tape a self-addressed postcard wrapped in thin plastic to each balloon. Include location and launch date on the card, along with a note asking the founder to mail the postcard back after adding to the postcard the date and place that the postcard and balloon were found. This activity could be done during different wind conditions and directions.
	Hand out copies of "Coriolis Force."
	Obtain a chalkglobe. Set the rotational axis in the vertical position and spin the globe rapidly. As the globe spins, dribble a few milliliters of water on the polar region. Have students trace the direction of water flowing toward the equator.
	Discuss the effect of turning on a merry-go-round. Ask students to describe how the force tends to move persons on the merry-go-round. Ask students to describe what happens if the speed of the merry-go-round is increased.

THE ATMOSPHERE

Chapter 9

LAYER	DEPTH (in miles)	TEMP.	GASES	DESCRIPTION

NAME______________________________ PERIOD__________ DATE______________

Experiment________: Air

Problem

Does air have weight?

Materials

2 balloons
string and matches
meter stick

Procedures

1. Blow up 2 balloons equally.
2. Tie each with an 8" string and attach to the meter stick 2" from each end.
3. Attach a string to the center of the meter stick and hang.
4. Be sure the stick is level so that it will be balanced.
5. Touch a lighted match to one balloon.

Observation

1. Do the balloons contain the same amount of air?
2. How can you prove it?
3. What was missing after the balloon burst?
4. Draw what you observed.

Before After

Conclusion

1. What did you observe when the balloon burst?
2. Does air have weight?
3. What is the air pressure at sea level?
4. What type of heat does the match give off?

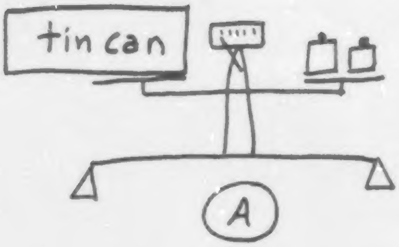
WEIGHING AIR (DEMONSTRATION)

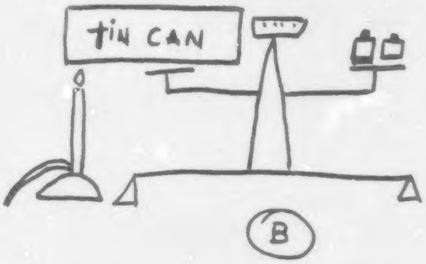
Materials

Empty gallon tin can
Platform balance
Bunsen burner
Metric weights

Procedure

1. Place open can on platform balance and weigh. Record this weight (cold).
2. Heat the end of the can with a burner for about 3 minutes.
3. Immediately weigh and record this weight.





Conclusion

1. What is the difference in weight between the heated and unheated container.
2. Allow the container to cool as it sits on the balance. Note the position of the pointer as the container cools.
3. Does the container lose or gain weight when heated? Explain.
4. Which is heavier? Warm air or cold air?

AIR PRESSURE (DEMONSTRATION)

Purpose

To show the force of air pressure

Materials

1 gallon can with a tight fitting top
Bunsen burner
water
ring stand

Procedure

1. Place about 1 inch of water in the bottom of the can. (CAUTION: DO NOT CLOSE CAN.)
2. Support can with the ring stand and heat to vigorous boil.
3. Let boil approximately 5 minutes.
4. Carefully (using gloves) remove the can and screw the cap on tightly.
5. Slowly pour cold water over the can and observe.

Conclusion

1. Define air pressure.
2. What causes air pressure?
3. What happened when the can was heated?
4. Describe what happened when cold water was poured on the can.
5. Explain why the can reacted as it did in Step #4.
6. How could rapid changes in air pressure such as in a tornado affect a house?

AIR MOVES BY CONVECTION

Purpose

To see how air moves from a heat source.

Materials

Aquarium
Opaque shield
Incense stick
Clay (base for punk stick)
ring stand and clamp
lightbulb (150-300 watt)
with extension cords

Procedure

- Attach the light bulb to the ring stand using the clamps.
- Make a clay base and put the stick of the incense into the clay. Then put this at one end of the aquarium.
- Light the incense and place the lightbulb where it will shine on the incense stick.
- Cover most of the lid with the opaque shield.
- Turn the light on and watch the smoke from the incense as it travels in the aquarium.
- Draw the way the smoke moves.
- Place the incense stick in the middle of the aquarium, put on the opaque shield and repeat your observations and drawings.

Observations

Drawings of air movement

Conclusion

Describe how air moved in the aquarium.

What did the lightbulb represent?

When the stick was moved to the middle of the aquarium, what happened?

CORIOLIS FORCE

Purpose

To observe the Coriolis effect

Materials

- Drawing compass
- Cardboard (23cm x 23 cm)
- Scissors
- Metric ruler
- Pencil with eraser
- Thumbtack
- Lump of clay
- Plastic squeeze bottle
- Water
- Food coloring

Procedure

- Use the compass to draw a 20cm diameter circle on a piece of cardboard. Cut the circular disk from the piece of cardboard. Mark the center of the disk.
- Tack the center of the cardboard disk to the top of the eraser on the pencil. Push the pointed end of the pencil into the lump of clay. The pencil should be vertical and the cardboard disk horizontal. Test the cardboard disk to be sure it can spin freely.
- Fill half the squeeze bottle with water. Add a few drops of food coloring to the water.
- The cardboard disk represents the earth. Spin the circle in a counterclockwise direction. At the same time, squirt a steady stream of water on top of the disk. Start at the center and rapidly move in a straight line to the edge. Observe the path made by the water.
- Spin the disk in a clockwise direction. Squirt a stream of water on the disk as you did before. Observe the path made by the water.

Results and Conclusions

1. Describe the path made by the water as the disk turned in a counterclockwise direction.
2. Describe the path made by the water as the disk turned in a clockwise direction.
3. How is motion affected by the earth's rotation in the Northern Hemisphere (counterclockwise direction)?
4. How is motion affected by the earth's rotation in the Southern Hemisaphere (clockwise direction)?

CHAPTER 9: SEASONS, CLIMATE, AND WATER

(Time Allotment: 4 days - One Semester)
10 days - Two Semesters)

Major Concepts to be Taught

- Factors which influence climates: water bodies, mountains, deserts, and cities
- Factors which influence weather
- Occurrence of severe weather
- Reading weather maps

Essential Learner Outcomes

The student will -

- Recognize threatening weather conditions and suggest appropriate precautionary actions.
- List at least two conditions that exist on planet eareth that enables life as we know it to exist.

Instructional Objectives

The student should be able to:

- e Identify and describe the cause and effect of the seasons.
- Describe the causes and types of climate.
- e Identify cloud formations and associate them with weather conditions.
- e Explain the basic causes of warm front, cold front, rain, thunderstorm, lightning, hail, tornado, and hurricane.
- e Identify cloud formations and associate them with weather conditions.
- Interpret a weather newscast or bulletin.

Assessment Guidelines

The student will -

- Define any four of these terms: dew, dew point, relative humidity, frost, condensation, evaporation, transportation.
- Use a world globe and replica of the sun to demonstrate the causes of the seasons.
- List factors which influence weather.
- Use either "cold air" or "hot air" to complete these statements:

________________ rises.
________________ settles.
________________ is less dense than ______________.
High air pressure is associated with ______________.
Low air pressure is associated with ______________.

- Name three kinds of storms and describe two of them.
- List the information needed to prepare a weather forecast.
- Read and interpret the weather bulletin from the newspaper.
- Name the three main cloud types and identify them from pictures.
- Give the other name for thunderstorms and briefly explain whey they occur.
- Define climate.
- Describe what conditions cause local climates.
- List four different types of local climates.
- Locate and track hurricanes.
- Keep a daily record.

Materials

Textbook: *Focus on Earth Science*, pages 164-183

Lab Manual: "Earth Science--A Learning Strategy for the Laboratory"
No. 25 - Air in Motion
No. 26 - Radiant Energy and Climate
No. 27 - Relative Humidity
No. 28 - Clouds
No. 29 - Weather Forecasting
No. 30 - Hurricanes

Earth Science Activity-Centered Program, Teacher's Guide
Page 65 - Extensions to Activity, 9-1
Page 65 - Additional Activity
Page 67 - Extensions to Activity (Sundial)
Page 68 - Additional Activity (Psychrometer)
Page 70 - Additional Activity (Rain gauge)
Page 72 - Additional Activity (Wind vane)
Page 75 - Additional Activity (Cloud ceiling)
Page 77 - Extensions to Activity, 9-2
Page 78 - Additional Activity (High and low pressure)

Focus on Earth Science Review and Reinforcement Guide
9:1 Organizing Factors that Affect Climate, page 45
9:2 Weather Words Crossword Puzzle, page 46
9:3 Plotting Temperature and Moisture, page 48
9:4 Finding Relative Humidity, page 49

Additional Suggestions

- A,B,C, pages 181-183
- Points to Remember, page 181
- Words to Use, page 81
- How and Why, page 183
- More Ideas to Explore, page 183
- Make a weather station for the school
- Pictures, posters, bulletin boards on clouds, storms, climates
- Guest speakers: weather forecaster, airplane pilots, etc.
- Research and safety rules on hurricanes and tornadoes

Films

L5449--The Weather Watchers (1968) 30 min.
M2669--What Makes Clouds
4437 --Lightning and Thunder

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Identify and describe the cause and effect of the seasons.	Use a large styrofoam ball, a double-pointed knitting needle, and a lamp or flashlight to demonstrate how the earth's axis causes seasonal changes. Push the double-pointed needle through the styrofoam ball. Hold the ball with the axis tilted at 23-1/2° angle from a vertical line on the floor. Walk around a lighted lamp on a table in a darkened room. Observe the amount of light falling on the poles. Construct a sun dial using the experiment on page 127 in the Activity Book. Research cities in different regions to determine what factors are affecting their weather. Students could do the activity on page 65 of the Activity Book. This activity demonstrates how the color of an object affect the absorption and radiation of solar energy. Give each student a sketch of the globe, and have them show the position of the sun relative to Earth in winter and in summer.
Discuss the cause and types of local climates.	Use the climate map on page 169 and a relief map of the world, and have students give reasons for the climate of a particular region. On a map of North America, show the distribution of rainfall. Display the map. *Collect pictures that show vegetation in the differenc North American climates. Display the pictures. Correlate this section with eighth-grade history if possible. Have student listen to weather forecasts for at least two weeks and collect weather information about the Houston-Galveston area (temperature, humidity, amount of precipitation) and compare this with the weather farther inland in such places as El Paso, Big Bend, etc. At the end of two weeks conduct a discussion on what affected the weather. Students should mention such things as mountains, deserts, cities, etc.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will –	@ Have interested students go to the library and look up information about the average monthly amount of precipitation and temperatures for several cities in the United States of the world. Have them graph the monthly averages for precipitation and temperature for each city and compare the cities' different climates. Have them try to decide what factors helped produce the differences or similarities in climate between two cities.
Identify cloud formations and associate them with weather conditions.	Explain to students that water vapor is the single most important component of the air in terms of weather.
	Define and spell correctly: dew, frost, dew point, relative humidity, condensation, evaporation, and transpiration.
	Have students observe and record information for "Will this dew?" Hand out copies of this activity to the students.
	Use Skillcards Nos. 69 and 70 with the problem on page 170. They offer a different approach to explaining relative humidity and dew point.
	Conduct the experiment on page 59 of the Lab Manual. Student will calculate relative humidity and record dew point.
	Plot temperature and moisture by doing exercise 9:3, page 48 of the Review Guide.
	Find the relative humidity by using Table 9-2, page 49 of the Review Guide.
	Using reference materials found in the library, have your students draw pictures of the following clouds: cirrus, stratus, cumulus, and cumulonimbus.
	Students can take a series of color photographs of the sky daily for 1 or 2 weeks. The time should be the same each day, whether morning, afternoon, or evening. During this time they could study the daily weather maps and try to associate their photographs with these maps. The color pictures could be

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	displayed in the room and the class could label the clouds as to their cloud types. (An Poloroid-type camera would be best for this rather than having to wait for film development.) Have interested students attempt to predict the weather by observing cloud formations and other weather observations. * Make a chart in the form of a calendar and draw in the weather conditions for each day. Have students determine the cloud ceiling by doing the activity on page 75 of the Activity Book. Obtain or construct an anemometer. Have the students record average daily wind velocity over a period of a week. See "Science Understanding Your Environment," Silver Burdett, Grade 6, Chapter 20. Obtain or construct a weather vane. Have the students record daily wind direction over a period of a week. See activity page 189 for instructions. Have students keep a record of wind forecasts for the same period. At the end of this period, have the students compare their records of wind direction and velocity with those forecasted. Make a simple hair hygrometer and explain how it works (remove grease from hair with soap). Let students use a wet-bulb and dry-bulb thermometer to find the relative humidity. You will find the activity "Weather and Climate-Calculating Relative Humidity" useful when doing this activity. Hand out copies to the students. * If possible, visit an airport. Have your students observe the instruments used to record temperature, relative humidity, pressure, wind velocity, and direction. Ask the airport meteorologists how weather predictions are made from the data collected.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	You may want to visit the Weather Information Central in Alvin, Texas. Find out how weather conditions are measured and how weather maps are prepared. If a field trip cannot be arranged, perhaps a weatherman could visit the class. Find pictures of instruments used for measuring weather conditions and prepare a bulletin-board display that describes how these instruments operate. Have the class make a usable weather station to be set up on the school grounds. Each small group could be responsible for making and demonstrating one instrument. Discuss the importance of being able to read and interpret weather instruments in boating and flying.
Explain the basic causes of warm front, cold front, rain, thunderstorms, lightning, hail, tornadoes, hurricanes.	On a map of the United States, students could plot the progress of a frontal system moving across the country by watching the weather forecast on the evening news for several days. Hand out copies of "Warm Meets Cold" and to conduct this experiment to see how a warm air mass and a cold air mass react at a front. Place weather maps for succeeding days on an opaque projector. Let the students discuss their conclusions concerning the speed at which air masses move across the country. Lab No. 30--Hurricanes. This activity helps the student learn how to track hurricanes. For a post-lab activity, the students could set up emergency plans for a hurricane warning. Their plans would need to be detailed to cover all safety factors. A visit to the Storm Center located at the University of St. Thomas would allow students to see how information about hurricanes is gathered, stored, and researched. Have individual students develop posters illustrating the following: how a tornado forms, the eye of a hurricane, the formation of a thunderstorm, and cyclones.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Have students compare the similarities and contrast the differences between hurricanes and tornadoes.
	Ask the students to do research on tornadoes and hurricanes. This activity could be expanded to include charts, posters, oral reports, group studies, etc.
Interpret a weather newscaster bulletin.	Describe how a meteorologist collects data.
	Distinguish between isobars and isotherms.
	Students could do the activity on page 78 of the Activity Book. In this activity, students can identify high and low pressure areas on a weather map.
	Have students keep track of daily movements of pressure systems, air masses, and fronts.
	Display a wall chart on which movements of weather systems can be plotted.
	Have students watch the weather forecast and write down symbols that are used on the map showing the United States. Have them tell what part of the country was experiencing high pressure and which was experiencing low pressure. Also have them write down the present weather condition and the next day's forecast.
	Explain the various symbols and discuss how these symbols are used on a weather map. Also, how the conditions throughout the country are used to forecast the weather.
	Hand out copies of "Weather In Short" and discuss and explain how to interpret weather maps.
	Have students make a weather map. Use the information given in "Making A Weather Map." Make copies to give to students.
	* Hand out copies of "Weather Maps." This activity will help students to read daily local weather maps.

PERFORMANCE OBJECTIVES

The student will --

SUGGESTED ACTIVITIES

@ Have some of your students prepare a weather broadcast for the class. They can make several weather maps to illustrate today's and tomorrow's weather.

@ Have students devise a method of recording weather observations on a large chart for the class. Students can predict the weather, record their predictions, and then calculate the percent of accuracy for their predictions.

Have students do Activity 9-2, page 179 of the textbook.

Refer students to Figure 9-9, page 178 of textbook. Have them plot weather information. See page 77 of the Activity Book for details.

Distribute copies of safety rules for the following: Tornadoes, flash flooding, hurricanes, lightning, and blizzards. Conduct a class discussion about these rules.

Collect pictures that show different forms of precipitation, such as sleet, snow, dew, and ice storms. Define and label.

Collect weather sayings such as "Red sky at night, sailor's delight; red sky in the morning, sailor take warning." Have the student test some of these to determine whether they are dependable. Also explore various myths for reliability; for example, "A ring around the moon means rain the next day."

Have students read Focus on Skills, page 180 of the textbook and answer the questions which follow:

> @ Some Students could do More Ideas to Explore, page 183 of text

Have students do Lab No. 29 - Weather Forecasting, page 65 in Lab Manual. In this activity, students will analyze weather data patrterns and predict coming weather.

NAME ________________________________ Period __________ Date ________________

Experiment ______: Will This Dew? (Weather)

Purpose

1. To check on day and night temperatures of several difference cities.
2. To determine the additional percent of water vapor the air at each location can hold.
3. To judge whether dew will condense at the given night temperature of each location.
4. To do the same for your own area and check to see if your prediction is correct.

Materials

Temperatures and humidity readings from local newspaper or weather report on local radio and television

Procedure

Read the following information carefully, then follow the instructions.

> Relative humidity is a percentage used to show the relationship between the amount of water vapor in the air and the maximum amount of water the air could hold at the same temperature. If the relative humidity is given as 75%, the air could hold 25% more water vapor before it became saturated. When air is saturated, it has 100% relative humidity, which is all the water vapor it can hold at that temperature without precipitation, such as rain or snow falling. When air is saturated, any drop in temperature causes moisture or dew to form. The temperature at which dew forms is called the dew point. At night when temperatures drop below the dew point, moisture collects on the ground and on plants because they have cooled more than the air has.

* Calculate the percentage of water vapor which the air of each locality listed could add before saturation at the day temperature. Write these percentages in the chart.
* Compute the temperature drop at night for each locality listed.
* Enter this value under "Temperature Range" in the chart.
* Place a check mark beside each city where dew would form at night. NOTE: A drop of 18 degrees F (Farenheit degrees) reduces the amount of water vapor the air can hold by half.
* Compute today's percentage of water vapor which the air of your own locality could add before saturation.
* Compute the difference between today's day and night temperatures in your own area.
* Decide whether dew should form tonight.
* Tomorrow, check to see if dew did form.

Questions

1. Could the air of any city hold more than a 50% increase in water vapor?

____

2. Which of the listed cities are located near the ocean?

____

3. Would you expect these coastal cities to have humid air?

____

4. Do coastal cities have a wide difference between day and night temperatures?

____

5. What cities might have rain rather than just dew? ______________

____

6. Was there dew on the grass in your locality when you checked? ________

7. Can you compute the temperature drop for the cities given? ________

City ______________ Temp ______________
______________ ______________
______________ ______________

8. a) Compute the amount of water vapor each city could add before saturation: __________ __________ __________

b) Which of the 3 would have dew? ______________

CITY	DAY (HIGH) TEMPER-ATURE	NIGHT (LOW) TEMPER-ATURE	TEMPER-ATURE RANGE F°	RELATIVE HUMIDITY AT THE HIGH TEMPERATURE	UNSATURATION PERCENTAGE OF WATER VAPOR THAT COULD BE ADDED
New York	91°F	75°F	16°	75%	25%
New Orleans	91°F	73°F		95%	
Kansas City, Kansas	92°F	71°F		65%	
Albuquerque	89°F	65°F		35%	
Phoenix	99°F	78°F		20%	
San Francisco	66°F	58°F		85%	
Honolulu	87°F	85°F		85%	
Juneau	50°F	51°F		95%	
(Your area)					

Conclusion

What if the temperature were just blow 32°F and the relative humidity were high. What form of precipitation would appear? ____________________

____

What if your location were on the ocean and condensation remained suspended in the air. What would this form of precipitation be called? ____________________

____

What have you learned from this experiment?

WARM MEETS COLD

Purpose

To see how a warm air mass and a cold air mass react at a front.

Materials

Aquarium
Clay
Piece of glass that will fit aquarium
food coloring
cold water
warm water

Procedure

- Obtain some clay and a piece of glass. Use the glass to divide the aquarium in half. The glass should fit snugly inside the aquarium.
- Place a thin strip of clay on each side of the piece of glass at the sides and bottom of the aquarium.
- Place warm water in one side of the aquarium and cold water in the other side.
- To the cold water add some food coloring so that you can tell the difference between the cold water and the warm water.
- Carefully raise the piece of glass out of the water. Observe how the mass of cold water reacts with the mass of warm water.

Results and Conclusions

1. Describe how the cold water moves.
2. What does the cold water force the warm water to do?
3. Relate the movements of cold water and warm water to the movement of air masses.

9. What is a hurricane "watch?" ______________________________

____

10. What is a hurricane "warning?" ______________________________

____

11. List some precautions that should be taken when there has been a hurricane warning issued.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

WEATHER IN SHORT

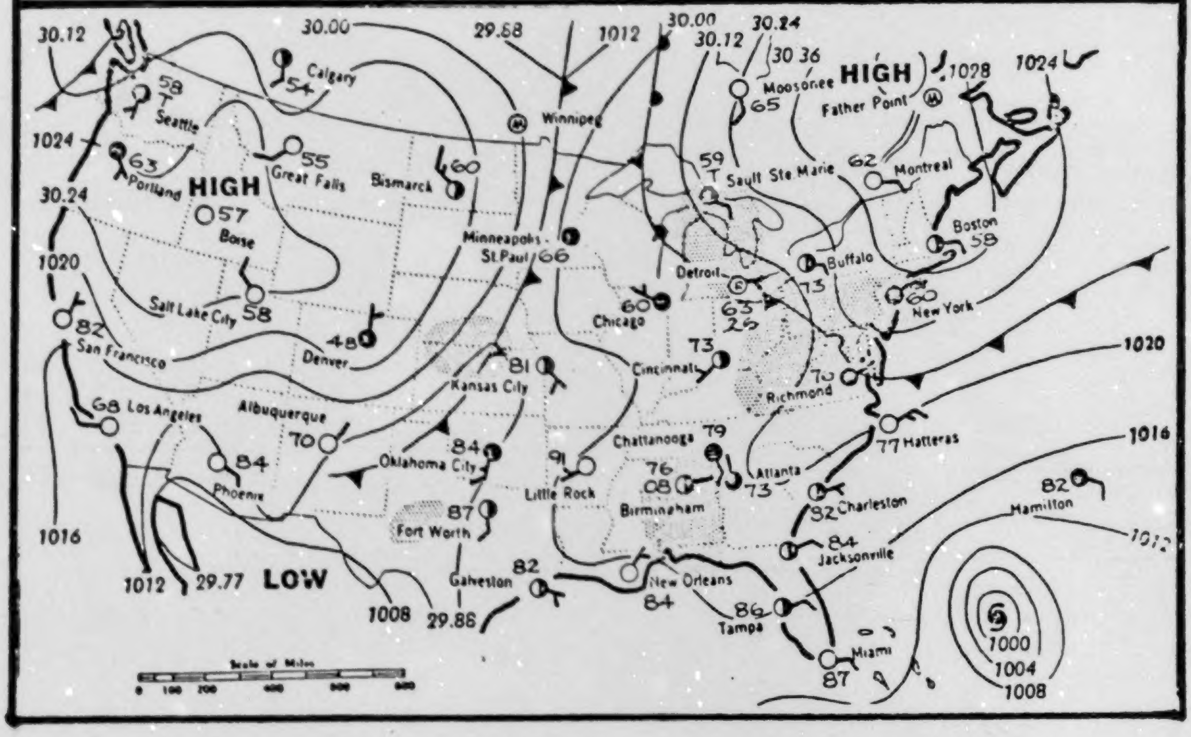
DIRECTIONS: Read the information below and answer questions that follow. Answer at least six questions correctly before moving on to the next activity.

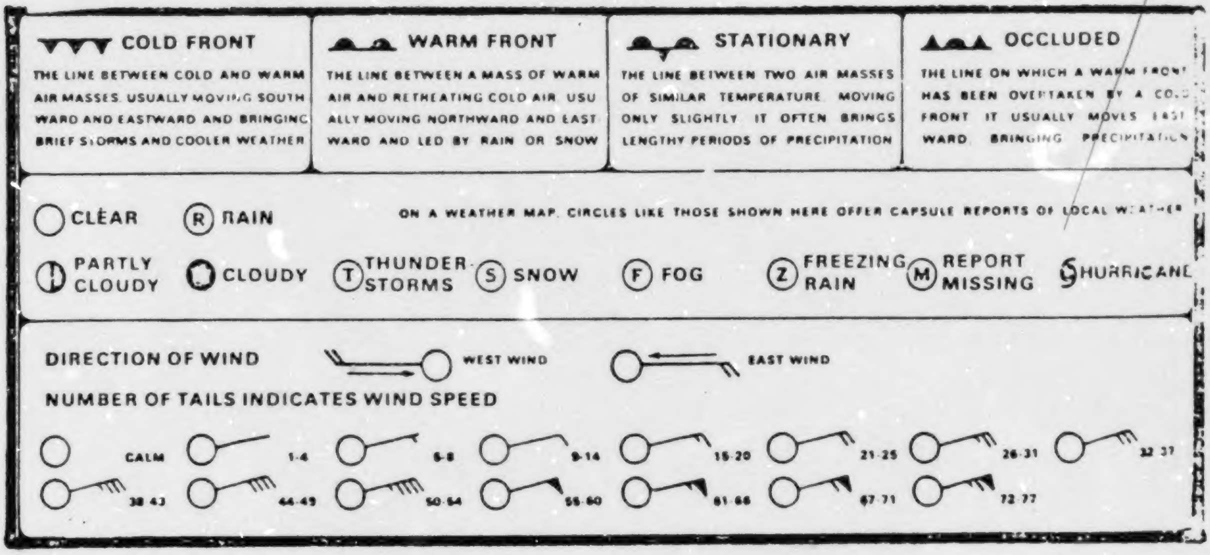
It is important that you learn how to read a weather map. The information on a weather map can help you make more accurate predictions about the weather.

A weather map shows the weather conditions throughout the United States. It gives you valuable information needed to predict the weather in your location--the type of weather your area will have tomorrow. Knowing this information can help you become adequately prepared for tomorrow's weather.

Official weather maps use a special kind of shorthand or symbols to show the weather conditions throughout the United States. Some of the information indicated on weather maps is barometric pressure readings, frontal systems, high and low pressure regions, temperature readings in Fahrenheit, precipitation, cloud cover, and wind direction and speed. The chart on the next page describes some of the symbols that are used on weather maps. Study the chart carefully, and practice reading the symbols on the national weather map on the next page.

NATIONAL WEATHER MAP


30.12
30.00
29.88
1012
30.00
30.12
30.24
30 36
1028
1024
HIGH
Moosonee
Father Point
Calgary
54
58
T
Seattle
Winnipeg
1024
63
Portland
55
Great Falls
Bismarck
60
30.24
HIGH
57
Boise
59
T
Sault Ste Marie
62
Montreal
65
Minneapolis-St. Paul
66
Boston
58
1020
Salt Lake City
58
Detroit
63
25
Buffalo
73
60
New York
82
San Francisco
48
Denver
60
Chicago
73
Cincinnati
1020
81
Kansas City
70
Richmond
68
Los Angeles
Albuquerque
70
Chattanooga
79
77
Hatteras
1016
84
Phoenix
84
Oklahoma City
91
Little Rock
76
08
Birmingham
Atlanta
73
82
Charleston
82
Hamilton
87
Fort Worth
84
Jacksonville
1012
1016
1012
29.77
LOW
1008
29.86
82
Galveston
New Orleans
84
86
Tampa
Miami
87
1000
1004
1008
Scale of Miles
0
100
200
400
600
800



COLD FRONT
WARM FRONT
STATIONARY
OCCLUDED

THE LINE BETWEEN COLD AND WARM AIR MASSES, USUALLY MOVING SOUTHWARD AND EASTWARD AND BRINGING BRIEF STORMS AND COOLER WEATHER

THE LINE BETWEEN A MASS OF WARM AIR AND RETREATING COLD AIR, USUALLY MOVING NORTHWARD AND EASTWARD AND LED BY RAIN OR SNOW

THE LINE BETWEEN TWO AIR MASSES OF SIMILAR TEMPERATURE, MOVING ONLY SLIGHTLY. IT OFTEN BRINGS LENGTHY PERIODS OF PRECIPITATION

THE LINE ON WHICH A WARM FRONT HAS BEEN OVERTAKEN BY A COLD FRONT. IT USUALLY MOVES EASTWARD, BRINGING PRECIPITATION

ON A WEATHER MAP, CIRCLES LIKE THOSE SHOWN HERE OFFER CAPSULE REPORTS OF LOCAL WEATHER

CLEAR
R RAIN
PARTLY CLOUDY
CLOUDY
T THUNDERSTORMS
S SNOW
F FOG
Z FREEZING RAIN
M REPORT MISSING
HURRICANE
DIRECTION OF WIND
WEST WIND
EAST WIND
NUMBER OF TAILS INDICATES WIND SPEED
CALM
1-4
5-8
9-14
15-20
21-25
26-31
32-37
38-43
44-49
50-54
55-60
61-66
67-71
72-77

The circle ○ is used to indicate a cloud coverage. The arrow is used to indicate wind direction and speed. The staff ╱ of the arrow indicates the direction of wind, and the pointers and flags indicate the speed.

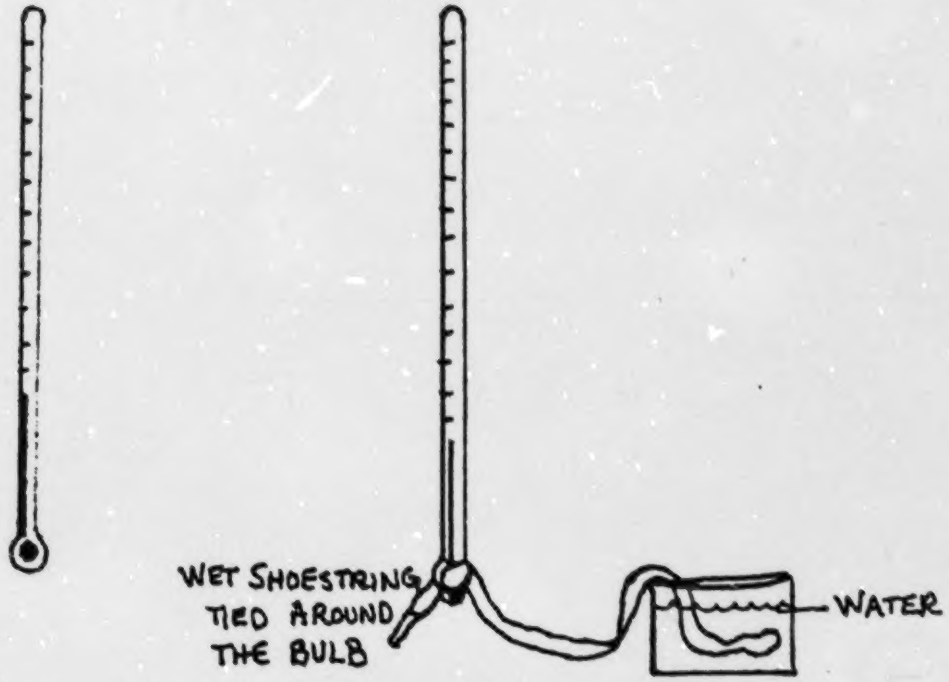
DAILY WEATHER RECORD

Date Begun ____________________ Date Ended ____________________

DATE	TEMP.	AIR PRESSURE	WIND		STATE OF SKY	% REL. HUMIDITY	CLOUD TYPE	PRESENT WEATHER	TOTAL PRECIPIT.
			VELOCITY	DIRECTION					

The relative humidity of the air can be measured. A hygrometer (hye-GRAH-muh-tuhr) is used to measure relative humidity. One type of hygrometer consists of two thermometers, one a dry-bulb and the other a wet-bulb. The lower end of the wet bulb thermometer is wrapped in a piece of wet cloth. The wet-bulb is cooled by evaporating water. The evaporation rate depends on the humidity of the surrounding air. Thus, the drier the air, the greater the rate of evaporation and the lower the temperature shown on the wet-bulb thermometer.

CALCULATING RELATIVE HUMIDITY



To find out the relative humidity in the classroom, set up the simple apparatus above. This is a wet-bulb and a dry-bulb setup.

Read the temperatures on both bulbs to fill in the formula below:

Dry-bulb reading = ____________

Wet-bulb reading = ____________

Difference = ____________

Using these readings, consult the chart on the back of this page to find the relative humidity. This can be done for several days to illustrate change.

Difference Between Dry- and Wet-Bulb Thermometers

°F	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Reading of dry-bulb thermometer °F	Relative humidity (percent)														
63	95	89	84	79	74	69	64	60	55	51	46	42	38	33	29
64	95	89	84	79	74	70	65	60	56	51	47	43	38	34	30
65	95	90	85	80	75	70	65	61	56	52	48	44	39	35	31
66	95	90	85	80	75	71	66	61	57	53	49	45	40	36	32
67	95	90	85	80	76	71	66	62	58	53	49	45	41	37	33
68	95	90	85	81	76	71	67	63	58	54	50	46	42	38	34
69	95	90	86	81	76	72	67	63	59	55	51	47	43	39	35
70	95	90	86	81	77	72	68	64	60	55	52	48	44	40	36
71	95	91	86	81	77	72	68	64	60	56	52	48	45	41	37
72	95	91	86	82	77	73	69	65	61	57	53	49	45	42	38
73	95	91	86	82	78	73	69	65	61	57	53	50	46	42	39
74	95	91	86	82	78	74	70	66	62	58	54	50	47	43	40
75	95	91	87	82	78	74	70	66	62	58	55	51	47	44	40
76	96	91	87	83	78	74	70	67	63	59	55	52	48	45	42
77	96	91	87	83	79	75	71	67	63	60	56	52	49	46	42
78	96	91	87	83	79	75	71	67	64	60	57	53	50	46	43
79	96	91	87	83	79	75	71	68	64	60	57	54	50	47	44
80	96	91	87	83	79	76	72	68	64	61	57	54	51	47	44

Suppose the dry-bulb thermometer reads 75°F, while the wet-bulb thermometer reads 65°F. The difference in readings is 10°. Find the number 10 in the row of numbers that is across the top of the table. Now, run your finger down the column until you find the number opposite the dry-bulb reading of 75°F. What will be the relative humidity in this case? __________ What is the relative humidity if the dry-bulb thermometer reads 80°F, while the wet-bulb thermometer reads 76°F? __________ Which example shows air to be drier? ____________________

Name ______________________________ Date ______________________

Finding the Relative Humidity

Purpose

To find the relative humidity of the classroom.

Materials

"Wet-bulb and dry-bulb thermometer," relative humidity table

Background

The weight of water vapor in a given volume of air is its absolute humidity. Air can hold only a certain amount of moisture at a certain temperature. When it holds all of the water vapor it can hold, it is said to be saturated. Relative humidity is the ratio of the weight of water vapor actually in the air compared to how much water vapor the air could hold if saturated. Saturated air has a relative humidity of 100%. One important factor that controls humidity is the temperature of the air. Warm air holds more water vapor than cold air.

Procedures

1. Record the room temperature on the dry thermometer.
2. Record the "wet-bulb" temperature.
3. Subtract the "wet-bulb" temperature from the dry-bulb temperature.
4. Look up the relative humidity in the accompanying Relative Humidity Table.

Observations and Questions

1. Temperature of dry-bulb thermometer ______________ °F.
2. Temperature of wet-bulb thermometer ______________ °F.
3. Difference between dry-bulb and wet-bulb temperatures. ______________ °F.
4. Relative humidity ______________ %
5. Define humidity. ______________________________
6. Warm air holds ______________ moisture than cold air.
7. On very cold days, why does the moisture in your breath condense as you exhale? ______________________________
8. Define dew point ______________________________
9. Why can't relative humidity be more than 100% ______________________________

____

10. Define precipitation. ______________________________

____

11. An instrument used to measure humidity is the ______________________________

____

12. Units used to measure humidity are ______________________________

13. When you perspire, your body is cooled by evaporation. Houston sometimes has 70% to 80% relative humidity. How does the relative humidity affect the cooling process of perspiration?

____

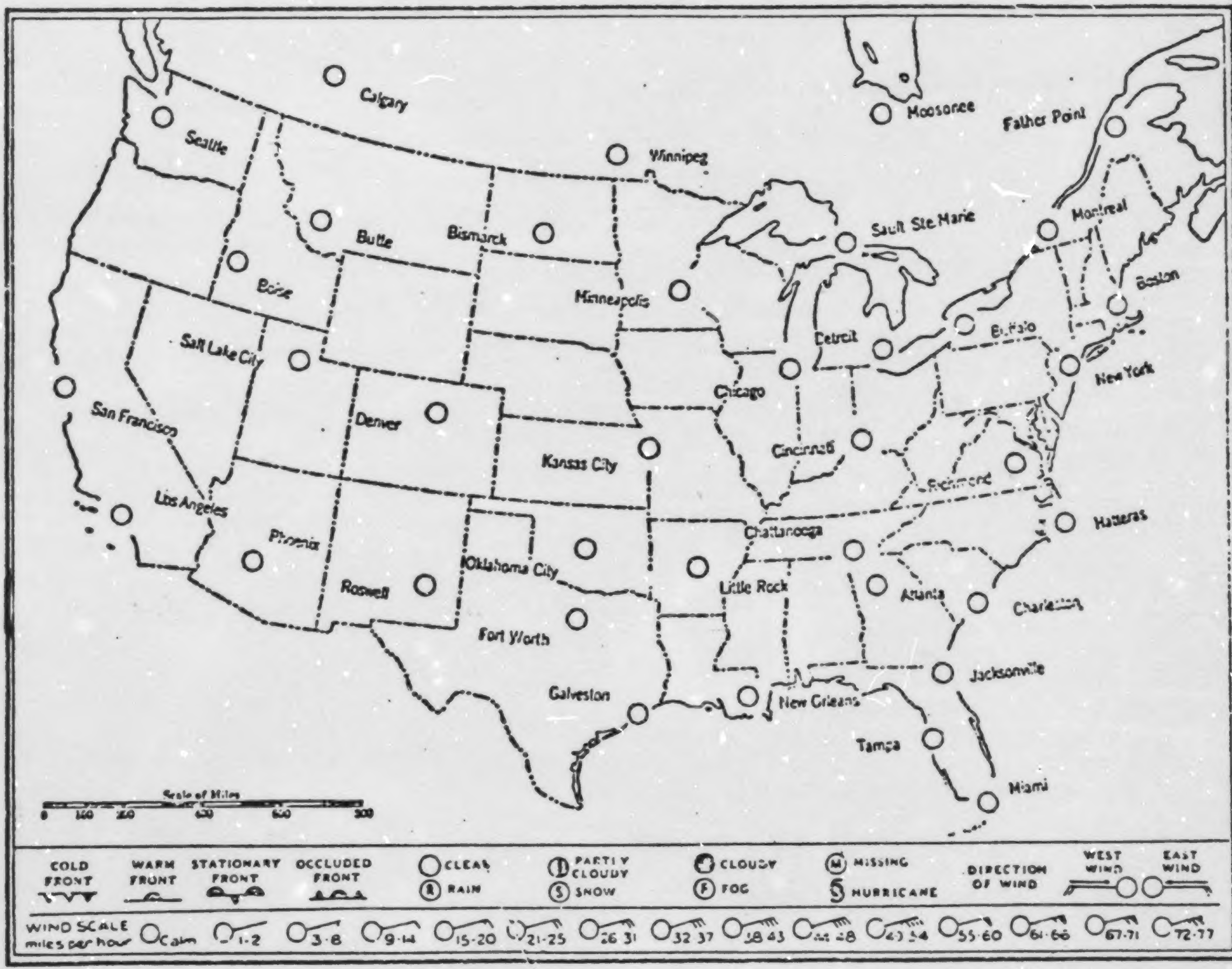
____

Making a Weather Map

Station	Wind Direction and Velocity (MPH)		Temperature (F)	State of Sky or Precipitation	Barometric Pressure (millibars)
Father Point, Canada	S.E.	6 mph	30°	Pt. Cloudy	1013.8
Montreal, Canada	E.	3	34°	Pt. Cloudy	1011.6
Boston, Mass.	N.E.	7	39°	Cloudy	1014.0
New York, NY	E.	9	42°	Rain	1011.0
Buffalo, NY	N.E.	10	40°	Cloudy	1008.1
Richmond, Va.	E.	14	45°	Rain	1008.0
Detroit, Mich.	N.E.	16	44°	Rain	1003.9
Sault Ste. Marie, Canada	N.E.	12	33°	Pt. Cloudy	1007.9
Chicago, Ill.	N.W.	10	40°	Fog	1004.1
Cincinnati, Ohio	S.W.	19	60°	Rain	1001.7
Chattanooga, Tenn.	S.W.	11	70°	Pt. Cloudy	1007.0
Atlanta, Ga.	S.	18	71°	Pt. Cloudy	1009.6
Hatteras, NC	S.E.	23	68°	Cloudy	1011.0
Charleston, SC	S.E.	22	71°	Pt. Cloudy	1014.0
Jacksonville, Fla.	S.	7	72°	Clear	1016.2
Tampa, Fla.	S.E.	13	77°	Pt. Cloudy	1017.0
Miami, Fla.	Calm		80°	Clear	1020.8
New Orleans, La.	S.W.	24	76°	Rain	1010.9
Galveston, Texas	N.W.	18	60°	Rain	1011.2
Little Rock, Ark.	N.W.	26	56°	Rain	1008.0
Minneapolis, Minn.	N.W.	28	34°	Pt. Cloudy	1010.1
Winnipeg, Canada	N.W.	30	27°	Cloudy	1011.0
Bismarck, ND	W.	24	30°	Pt. Cloudy	1013.8
Kansas City, Mo.	N.W.	7	50°	Clear	1011.0
Oklahoma City, Okla.	N.W.	17	54°	Clear	1013.4
Fort Worth, Texas	N.W.	31	58°	Clear	1013.9
Roswell, NM	N.	18	57°	Clear	1016.3
Phoenix, Ariz.	N.E.	6	68°	Clear	1017.0
Denver, Colo.	N.W.	5	51°	Clear	1020.0
Butte, Mont.	S.	23	47°	Pt. Cloudy	1020.0
Calgary, Canada	S.W.	34	26°	Pt. Cloudy	1014.0
Seattle, Wash.	S.E.	12	55°	Pt. Cloudy	1014.0
Boise, Idaho	S.E.	30	49°	Clear	1021.0
Salt Lake City, Utah	W.	2	57°	Clear	1025.0
Los Angeles, Calif.	N.E.	15	62°	Clear	1015.0
San Francisco, Calif.	E.	7	60°	Clear	1014.0

Transfer all of the above information to the weather map.

Draw in the warm and cold fronts.


Calgary
Moosonee
Father Point
Seattle
Winnipeg
Butte
Bismarck
Sault Ste Marie
Montreal
Boise
Minneapolis
Boston
Salt Lake City
Detroit
Buffalo
Chicago
New York
San Francisco
Denver
Cincinnati
Kansas City
Richmond
Los Angeles
Hatteras
Chattanooga
Phoenix
Oklahoma City
Little Rock
Atlanta
Roswell
Charleston
Fort Worth
Jacksonville
Galveston
New Orleans
Tampa
Miami
Scale of Miles
0
100
200
400
600
800
COLD FRONT
WARM FRONT
STATIONARY FRONT
OCCLUDED FRONT
CLEAR
RAIN
PARTLY CLOUDY
SNOW
CLOUDY
FOG
MISSING
HURRICANE
DIRECTION OF WIND
WEST WIND
EAST WIND
WIND SCALE miles per hour
Calm
1-2
3-8
9-14
15-20
21-25
26-31
32-37
38-43
44-48
49-54
55-60
61-66
67-71
72-77

BEST COPY AVAILABLE

Weather Maps

Purpose

To learn to read daily weather maps.

Materials

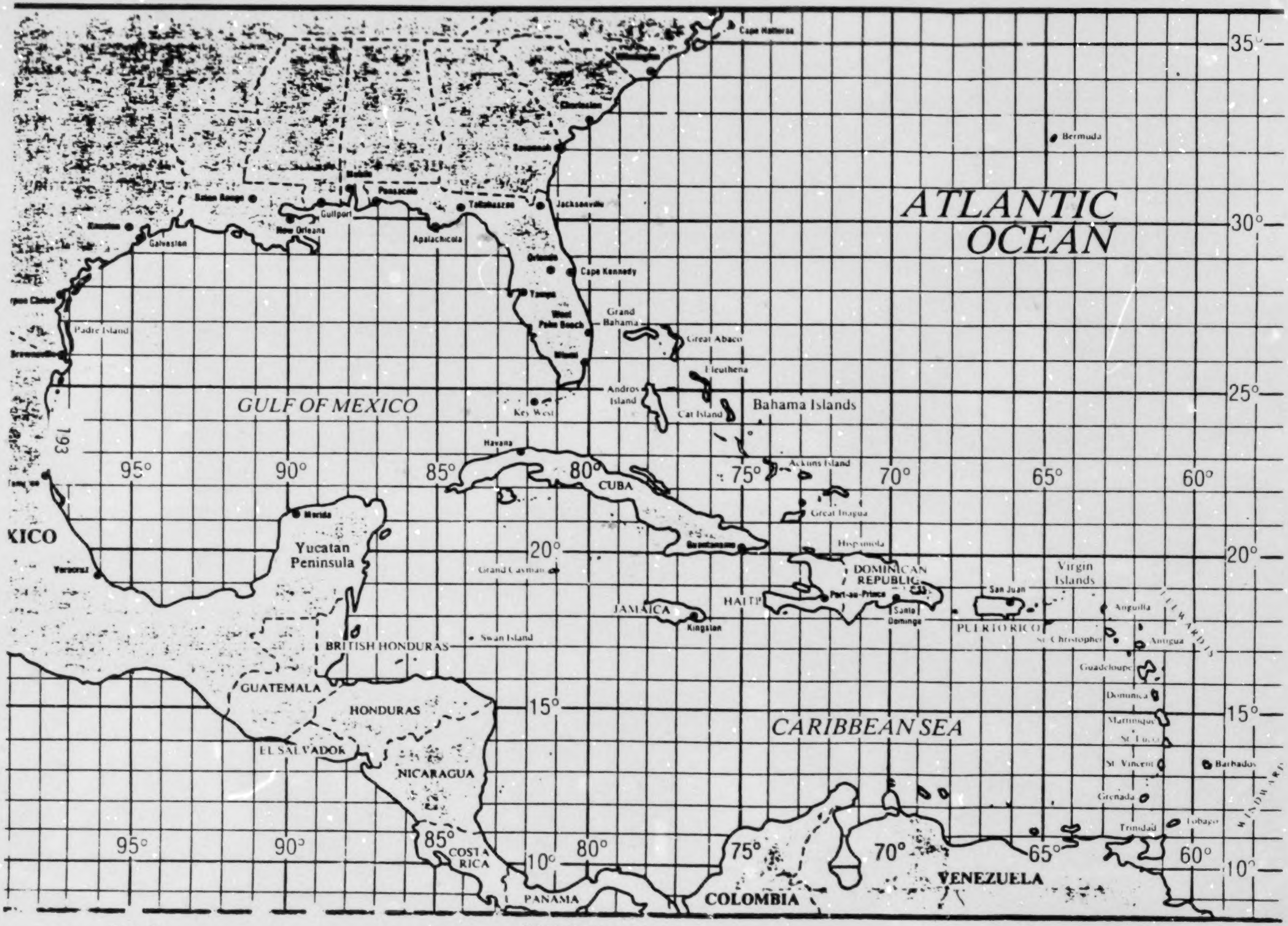
Weather map, scissors, glue, weather symbols

Procedure

1. Cut weather map from newspaper and glue it in lab tablet.
2. Draw weather symbols from overhead projector.
3. Answer questions below.

Conclusions

1. What is weather?
2. What four factors of the atmosphere determine weather?
3. List any of these factors that you see represented on your weather map.
4. According to your map, what is the temperature in Houston?
5. Is Houston in a high or low pressure area on your map?
6. Is there any form of precipitation in Houston?
7. Is there a front approaching Houston? If yes, name the type.
8. Describe the weather in Houston today.


ATLANTIC OCEAN
GULF OF MEXICO
CARIBBEAN SEA
Bahama Islands
Cape Hatteras
Charleston
Savannah
Jacksonville
Bermuda
Baton Rouge
Mobile
Pensacola
Tallahassee
Gulfport
New Orleans
Houston
Galveston
Apalachicola
Orlando
Cape Kennedy
Tampa
West Palm Beach
Miami
Grand Bahama
Great Abaco
Eleuthera
Andros Island
Cat Island
Key West
Padre Island
193
Havana
CUBA
Acklins Island
Great Inagua
Guantanamo
Hispaniola
DOMINICAN REPUBLIC
HAITI
Port-au-Prince
Santo Domingo
JAMAICA
Kingston
Grand Cayman
Swan Island
San Juan
PUERTO RICO
Virgin Islands
Anguilla
St. Christopher
Antigua
LEEWARDS
Guadeloupe
Dominica
Martinique
St. Lucia
St. Vincent
Barbados
Grenada
Tobago
Trinidad
WINDWARD
MEXICO
Merida
Yucatan Peninsula
Veracruz
BRITISH HONDURAS
GUATEMALA
HONDURAS
EL SALVADOR
NICARAGUA
COSTA RICA
PANAMA
COLOMBIA
VENEZUELA
35°
30°
25°
20°
15°
10°
95°
90°
85°
80°
75°
70°
65°
60°

BEST COPY AVAILABLE

Chapter 10: Oceanography

(Time Allotment - 3 days - One Semester)
9 days - Two Semesters)

Major Concepts to be Taught

The hydrologic cycle
Composition of ocean water
Classification of ocean life
Topography of the ocean floor

Instructional Objectives

The student should be able to:

B . define and trace the movements of water in the hydrologic cycle.
B . describe the composition and sources of sea water.
. describe the organisms classified as nekton, benthos, plankton and explain the inter-relationships of these groups.
. Identify variations found in the ocean floor topography and describe the methods and equipment used in this study.
B . Identify and describe the features of the ocean floor.

Assessment Guidelines

The student will:

- Define hydrologic cycle.
- *Look at a drawing, similar to figure 10-1 on page 125, and explain the stages of the hydrologic cycle.
- Discuss the composition of sea water by identifying and using three of these terms:
  - brine
  - halite
  - volcanic eruptions
  - weathering of rocks
  - sodium chlorine
  - salinity
- Define distillation.
- Name the basic link in the food chain of the seas.
- *Classify the following organisms as nektons, benthos, plankton:
  - sponge
  - squid
  - diatoms
  - sea horse
  - algae
  - jelly fish
  - whales
  - crab
  - starfish
- Describe four of the following equipment or methods used in ocean research:
  - bathysphere
  - Nansen bottles
  - hygrometer
  - echo sounding
  - sonar
  - radar
  - seismograph survey
  - Trieste
  - H.M.S. Challenger

- *Label on a drawing of the cross-section of the ocean floor:

    continental shelf
    continental slope
    trench
    volcanic peaks
    abyssal plain
    mid-ocean ridge
    rift zone
    sea level

- Choose four of the ocean features and give two characteristics of each:

    continental shelf
    continental slope
    trench
    volcanic peaks
    abyssal plain
    mid-ocean ridge
    rift zone
    sea level

Materials

Textbook: Focus on Earth Science, pages 184-199

Earth Science Skillcards:
No. 63 - Oceans - Minerals for section 11:2 page 206
No. 64 - Oceans - Mineral Preparation for section 11:5 page 217
No. 65 - Oceans - Salinity for section 11:2 page 207
No. 66 - Oceans - Density and buoyancy for section 11:2 page 206
No. 68 - Weather - Hydrologic Cycle for section 11:1 page 204

Lab Manual: "Earth Science--A Learning Strategy for the Laboratory"
No. 31 - Salt Concentrations in Ocean Water
No. 33 - Floating in Fresh Water and in Ocean Water
No. 35 - Ocean Life

Additional Suggestions:
- A,B,C, pages 197-199
- Points to Remember, pages 197
- Words to Use, page 197
- How and Why, page 199
- More Ideas to Explore, page 199
- Papier Mache model of the ocean floor features
- Set up a salt water aquarium

Focus on Earth Science Review and Reinforcement Guide
10:1 - Understanding the Water Cycle, page 51
10:2 - Composition of Ocean Water, page 52
10:3 - Mapping the Ocean Floor, page 53

Films:
M5880 - Oceans of Water but None to Spare (1971) 22 min.
M6214 - Life Under the Sea-Marine Fauna (1970) 16 min.
6001 - Food Chains in the Ocean (1971) 9 min.
5990 - Energy and Living Things (coral reef) 1972 11 min.
5999 - A Community Beneath the Ses (Ecology) 1971 9 min.
5634 - The Sixth Continent (The Ocean Floor) 1970 29 min.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	
Define and trace the movement of the hydrologic cycle.	Have students do Skillcard No. 68 - Hydrologic Cycle. This activity shows evaporation, condensation, and "rain."
	Have students do the experiment on page 186. In this activity, students will demonstrate the water cycle.
	Have students do Understanding the Water Cycle, page 51 of the Review Guide.
	Some students could make a poster on the hydrologic cycle. Students could refer to drawing (Figure 10-1) on page 185. Many students enjoy using colored chalk to put this on the board.
	To help students compare the size of the ocean's area to the area of the landmasses, have them trace a map of the world on a piece of graph paper. After they have traced the map, have them cut out the landmasses and place the landmasses and oceans in separate piles. By counting the number of squares on the graph paper for both the oceans and landmasses the students will be able to see that the area of the world's ocean is about three times that of landmasses.
	Students could assign library research on the oceans. See "Topics for Library Research."
Describe the composition and sources of sea water.	Skillcard No. 63 - Minerals. This activity demonstrates how to remove minerals by evaporation.
	Skillcard No. 65 - Salanity. Explains why the ocean waters are increasing in salinity.
	Refer to Chemistry of Sea Water and have students make a graph of the ten most common elements dissolved in sea water.
	Have students do the activity on Skillcard No. 66 - Density and Buoyancy or Lab No. 31 - Sink or Float. This activity compares the buoyancy factor of fresh and salt water.
	Refer to the table - Corresponding Densities and Salinities, for comparisons of density and salinity.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Have students do Salt Concentration in Ocean Water, page 71 of the Lab Manual. Compare bouyancy in fresh water with salt, page 75 of the Lab Manual. Students could do exercise 10:2 Composition of Ocean Water, page 52 in the Review Guide.
Describe the organisms classified as nekton, benthos, plankton, and explain the interrelationships of these three groups.	Start a saltwater aquarium. Refer to the appendix for "Materials Needed for Maintaining Saltwater Aquariums," "Maintaining a Saltwater Aquarium," "A Crab Terrarium," "Display of Specimens," and "Do's and Don'ts for Maintaining A Successful Aquarium." @ Give students copies of "Specimen Unique to the Galveston Island Area" and have them identify which organisms are nekton, benthos, and plankton. Refer to Appendix for "Bottom Dwellers of the Upper Texas Coast." Have some students prepare a chart of the types of organisms found in the three major zones of the ocean. Students can use pictures cut from magazines or make their own drawings. Have them label each organism and give its life zone. * Lab No. 35 - Ocean Life, page 79 of Lab Manual. The students are to collect pictures and shells for a bulletin board. These examples will be classified according to the three groups. A food chain can be established from organisms displayed. Students could give an oral report and show literature from Sea Arama. Those who have not been may be able to plan a weekend activity with their family to visit Sea Arama and Sea Wolf Park in Galveston, Texas. Students can visit the gulf coast area on extreme low tide and walk the beaches to find sea life that is usually not noticeable.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Identify variations found in the ocean floor topography and explain the methods and equipment used in this study.	@ On a map of the world, have the students trace the mid-ocean mountain ridge and show how it seems to connect through all the earth's oceans, explaining what is thought to be its origin. @ Have the students use a map to explain what the major regions of volcanic activity are in the sea and how the locations of these regions compare with the locations of island structures in the deep sea. * There is an activity on sonar sounding on page 53 of the Review Guide, exercise 10:3 - Mapping the Ocean Floor. *Draw or collect pictures on submersibles or other underwater equipment. @ Read Twenty Thousand Leagues Under the Sea by Jules Verne. Compare this fiction book with what is actually known about the oceans. Watch Jacques Costeau specials on television or read some of his publications. (Put a student "in charge" of checking the TV guide each week for specials in the earth sciences - National Geographic, etc.) Students who have toured Sea Wolf Park in Galveston could share their pictures and information with the class. @ Research the achievements ofd the H.M.S. Challenger and Glomar Challenger. * Have students look up and report on these submersibles used to explore the ocean bottom: Aluminact, Deep Star, Deep Ocean Work Boat (DOWB) and Alvin. * Have your students collect current newspaper and magazine articles dealing with new discoveries about the ocean. These articles can be placed on the bulletin board or discussed with the class. @ Have interested students prepare brief reports on the use of the continental shelves by the fishing industry or by major oil companies to drill for oil.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	
Identify and describe the features of the ocean floor.	Skillcard No. 64 - Mineral Precipitation. This activity explains the formation of nodules on the ocean floor. Students could investigate ways of bringing up these mineral nodules. There are articles on the manganese nodules. (Check Readers' Guide in library.) * Students enjoy making papier mache or "baker's clay" replicas on the ocean floor. All features could be labeled and painted. A real challenge would involve making the model to scale.

Chemistry of Sea Water

Basic Concepts

Sea water is distinguished from ordinary or "fresh" water by its salinity. When the marine chemist refers to "salinity," he is speaking of all the dissolved substances in the sea water, not just pure sodium chloride, or salt, as we know it. True saltness is of less significance to a chemist than the total of all the chemical salts dissolved in the sea. The ten most common substances found in sea water are as follows:

Mineral Composition of Sea Water (10 Chief Substances)

Element	Parts per Thousand
Chlorine - (Cl)	18.98
Sodium - (Na)	10.56
Magnesium - (Mg)	1.27
Sulphur - (S)	0.88
Calcium - (Ca)	0.40
Potassium - (K)	0.38
Bromine - (Br)	0.065
Carbon - (C)	0.028
Strontium - (Sr)	0.013
Boron - (B)	0.005

Note: This chart can be used as student research and activity, or it can be teacher presented.

Mining the Sea

One of the aims of oceanography is to discover practical ways of reclaiming valuable substances from the sea for human use. Some of these substances are in solution in the sea water. while others are found in larger particles, nodules, nuggets, grains, or veins laid down in the sediments.

Listed below are some of the materials in which chemical oceanographers are interested. Methods of reclaiming some of these substances and advances which have been made in this direction make a good topic for individual development. Almost every one of the books listed in the general section of the bibliography has some information on this topic.

Salt - sodium chloride

"Fresh" water

Diamonds - A developer has three vessels working in the continental shelf sediments off the coast of West Africa obtaining industrial diamonds.

Gold - As yet no practical method for extraction of gold has been developed, but it is a topic of research. The most likely source at present is probable gold-bearing sand on certain continental margins.

Iron Ore - Some iron is being reclaimed by Japan from offshore sediments.

Manganese - At present the world's supply of manganese is secured from the sea, where it is found in sizeable nodules on almost all parts of the ocean floor. These lumps also contain nickel, cobalt, and copper. About 112,000 tons per square mile of ocean bottom can be found in some parts of the Pacific Ocean.

Concentrations of minerals in various marine animals are being obtained: iron, cobalt, and copper in mollusks; iodine in sponges and seaweed; vanadium in the sea cucumber, and many others.

Oil - Offshore drilling on continental shelves produces large amounts of oil.

Sulphur is being reclaimed by drilling on continental shelves.

Food from the sea - Here the work of the chemical and the biological oceanographer overlap, as in fact, do all the sciences involved in oceanography.

Corresponding Densities and Salinities

(Density at 15°C. -- Salinity in parts per 1000)

Density	Salinity	Density	Salinity	Density	Salinity	Density	Salinity	Density	Salinity	Density	Salinity
0.9991	0.0	1.0046	7.1	1.0101	14.2	1.0156	21.4	1.0211	28.6	1.0266	35.8
0.9992	0.0	1.0047	7.2	1.0102	14.4	1.0157	21.6	1.0212	28.8	1.0267	35.9
0.9993	0.2	1.0048	7.3	1.0103	14.5	1.0158	21.7	1.0213	28.9	1.0268	36.0
0.9994	0.3	1.0049	7.5	1.0104	14.6	1.0159	21.8	1.0214	29.0	1.0269	36.2
0.9995	0.4	1.0050	7.6	1.0105	14.8	1.0160	22.0	1.0215	29.1	1.0270	36.3
0.9996	0.6	1.0051	7.7	1.0106	14.9	1.0161	22.1	1.0216	29.3	1.0271	36.4
0.9997	0.7	1.0052	7.9	1.0107	15.0	1.0162	22.2	1.0217	29.4	1.0272	36.6
0.9998	0.8	1.0053	8.0	1.0108	15.2	1.0163	22.4	1.0218	29.5	1.0273	36.7
0.9999	0.9	1.0054	8.1	1.0109	15.3	1.0164	22.5	1.0219	29.7	1.0274	36.8
1.0000	1.1	1.0055	8.2	1.0110	15.4	1.0165	22.6	1.0220	29.8	1.0275	37.0
1.0001	1.2	1.0056	8.4	1.0111	15.6	1.0166	22.7	1.0221	29.9	1.0276	37.1
1.0002	1.3	1.0057	8.5	1.0112	15.7	1.0167	22.9	1.0222	30.1	1.0277	37.2
1.0003	1.5	1.0058	8.6	1.0113	15.8	1.0168	23.0	1.0223	30.2	1.0278	37.3
1.0004	1.6	1.0059	8.8	1.0114	16.0	1.0169	23.1	1.0224	30.3	1.0279	37.5
1.0005	1.7	1.0060	8.9	1.0115	16.1	1.0170	23.3	1.0225	30.4	1.0280	37.6
1.0006	1.9	1.0061	9.0	1.0116	16.2	1.0171	23.4	1.0226	30.6	1.0281	37.7
1.0007	2.0	1.0062	9.2	1.0117	16.3	1.0172	23.5	1.0227	30.7	1.0282	37.9
1.0008	2.1	1.0063	9.3	1.0118	16.5	1.0173	23.7	1.0228	30.8	1.0283	38.0
1.0009	2.2	1.0064	9.4	1.0119	16.6	1.0174	23.8	1.0229	31.0	1.0284	38.1
1.0010	2.4	1.0065	9.6	1.0120	16.7	1.0175	23.9	1.0230	31.1	1.0285	38.2
1.0011	2.5	1.0066	9.7	1.0121	16.9	1.0176	24.1	1.0231	31.2	1.0286	38.4
1.0012	2.6	1.0067	9.8	1.0122	17.0	1.0177	24.2	1.0232	31.4	1.0287	38.5
1.0013	2.8	1.0068	9.9	1.0123	17.1	1.0178	24.3	1.0233	31.5	1.0288	38.6
1.0014	2.9	1.0069	10.1	1.0124	17.2	1.0179	24.4	1.0234	31.6	1.0289	38.8
1.0015	3.0	1.0070	10.2	1.0125	17.4	1.0180	24.6	1.0235	31.8	1.0290	38.9
1.0016	3.2	1.0071	10.3	1.0126	17.5	1.0181	24.7	1.0236	31.9	1.0291	39.0
1.0017	3.3	1.0072	10.5	1.0127	17.7	1.0182	24.8	1.0237	32.0	1.0292	39.2
1.0018	3.4	1.0073	10.6	1.0128	17.8	1.0183	25.0	1.0238	32.1	1.0293	39.3
1.0019	3.5	1.0074	10.7	1.0129	17.9	1.0184	25.1	1.0239	32.3	1.0294	39.4
1.0020	3.7	1.0075	10.8	1.0130	18.0	1.0185	25.2	1.0240	32.4	1.0295	39.6
1.0021	3.8	1.0076	11.0	1.0131	18.2	1.0186	25.4	1.0241	32.5	1.0296	39.7
1.0022	3.9	1.0077	11.1	1.0132	18.3	1.0187	25.5	1.0242	32.7	1.0297	39.8
1.0023	4.1	1.0078	11.2	1.0133	18.4	1.0188	25.6	1.0243	32.8	1.0298	39.9
1.0024	4.2	1.0079	11.4	1.0134	18.6	1.0189	25.8	1.0244	32.9	1.0299	40.1
1.0025	4.3	1.0080	11.5	1.0135	18.7	1.0190	25.9	1.0245	33.1	1.0300	40.2
1.0026	4.5	1.0081	11.6	1.0136	18.8	1.0191	26.0	1.0246	33.2	1.0301	40.3
1.0027	4.6	1.0082	11.8	1.0137	19.0	1.0192	26.1	1.0247	33.3	1.0302	40.4
1.0028	4.7	1.0083	11.9	1.0138	19.1	1.0193	26.3	1.0248	33.5	1.0303	40.6
1.0029	4.8	1.0084	12.0	1.0139	19.2	1.0194	26.4	1.0249	33.6	1.0304	40.7
1.0030	5.0	1.0085	12.2	1.0140	19.3	1.0195	26.5	1.0250	33.7	1.0305	40.8
1.0031	5.1	1.0086	12.3	1.0141	19.5	1.0196	26.7	1.0251	33.8	1.0306	41.0
1.0032	5.2	1.0087	12.4	1.0142	19.6	1.0197	26.8	1.0252	34.0	1.0307	41.1
1.0033	5.4	1.0008	12.6	1.0143	19.7	1.0198	26.9	1.0253	34.1	1.0308	41.2
1.0034	5.5	1.0089	12.7	1.0144	19.9	1.0199	27.1	1.0254	34.2	1.0309	41.4
1.0035	5.6	1.0090	12.8	1.0145	20.0	1.0200	27.2	1.0255	34.4	1.0310	41.5
1.0036	5.8	1.0091	12.9	1.0146	20.1	1.0201	27.3	1.0256	34.5	1.0311	41.6
1.0037	5.9	1.0092	13.1	1.0147	20.3	1.0202	27.5	1.0257	34.6	1.0312	41.7
1.0038	6.0	1.0093	13.2	1.0148	20.4	1.0203	27.6	1.0258	34.8	1.0313	41.9
1.0039	6.2	1.0094	13.3	1.0149	20.5	1.0204	27.7	1.0259	34.9	1.0314	42.0
1.0040	6.3	1.0095	13.5	1.0150	20.6	1.0205	27.8	1.0260	35.0	1.0315	42.1
1.0041	6.4	1.0096	13.6	1.0151	20.8	1.0206	28.0	1.0261	35.1	1.0316	42.3
1.0042	6.6	1.0097	13.7	1.0152	20.9	1.0207	28.1	1.0262	35.3	1.0317	42.4
1.0043	6.7	1.0098	13.9	1.0153	21.0	1.0208	28.2	1.0263	35.4	1.0318	42.5
1.0044	6.8	1.0099	14.0	1.0154	21.2	1.0209	28.4	1.0264	35.5	1.0319	42.7
1.0045	6.9	1.0100	14.1	1.0155	21.3	1.0210	28.5	1.0265	35.7	1.0320	42.8

BEST COPY AVAILABLE

Topics for Library Research

UNIT II. Geological, Chemical, Physical and Meteorological Aspects of the Marine Environment

The Origin of the Oceans
Continental Drift
Submarine Topography
Glaciation
Dating of Geological Samples
Echo-sounding
Effects of Tides on Marine Life
The Nature of the Gulf Stream
Effects of Currents on Marine Life
Wave Erosion

The Origin of Tsunamis
The Nature of Thermoclines
The Effects of Temperature on Marine Life
Survival Under Pressure
The Penetration of Light in the Oceans
Bathythermographs
Effects of Salinity on Marine Life
Chemical Composition of Sea Water
Nitrogen Cycle in the Ocean

UNIT III. Natural History of Marine Life

Photosynthesis
Distibution and Importance of Marine Grasses
Biological Importance of Plankton
The Economic Importance of Sponges
The Oyster Industry in Texas
Shrimp Fisheries
Digestive Processes in Marine Life

A Survey of Nervous Systems of Marine Life
The Formation of Shells by Mollusks
Regeneration
Lungfishes
The Development of Fish Scales
Adaptations of Deep Sea Fishes
Sea Turtles
The Coelacanth

UNIT IV. Marine Ecology

Food Chain Concepts
Symbiotic Relationships
Commensalism in the Oceans
Parasitism
Schooling Behavior of Fishes
Adaptations for Swimming
The Importance of Estuaries

Gill Mechanics
Pigmentation and Survival
Bio-luminescence
Adaptations for Feeding
A Survey of Reproduction in Marine Life
Water Pollution

UNIT V. The Conquest of the Oceans

Early Notions about the Sea and Its Inhabitants
The Challenger Expedition
Robots Under the Sea

IGY Oceanographic Activities
Minerals from the Sea
Ocean Science and National Security

Kraken: Myth of the Giant Squid
A Survey of Recent Oceanographic Expedition
U.S Fish and Wildlife Service
U.S. Department of the Navy
U.S. Oceanographic Office
National Oceanographic Data Center
National Academy of Sciences, Committee on Oceanography
Atomic Energy Commission
Texas Parks and Wildlife
Future Food Resources from the Sea
New Fishing Techniques for Improving the Catch
Ocean Conservation
Organization and Activities of a Marine Laboratory
Harnessing Ocean Power
Fresh Water from the Sea
Marine Corrosion
Medical Research and the Ocean
Sports Fishing in Texas
Marine Fisheries in Texas
Marine Conservation in Texas
Present Food Resources from the Sea
World Population Problems
History of Diving
Underwater Television
Marine Laboratories Under the Sea
Submarine Research Vessels

G. SPECIMEN UNIQUE TO THE GALVESTON ISLAND AREA

	SPECIMENS	SITES				
		1	2	3	4	5
	BENTHOS					
1.	ANGEL WING *Cyrtopleura costata*					
2.	ARK, BLOOD *Arca or Anadara ovalis*					
3.	ARK, EARED *Anadara notabilis*					
4.	ARK, INCONGRUOUS *Arca Incongrua* or *Anadara brasiliana*					
5.	ARK, PONDEROUS *Noetia ponderosa*					
6.	BARNACLE, GOOSENECK *Lepas fascicularis*					
7.	BARNACLE, ROCK *Balanus balanoides*					
8.	BRITTLE STAR *Ophiopholis aculeata*					
9.	CHANNELED DUCK CLAM *Anatina plicatella* *(canaliculata)*					
10.	CLAM, MACOMA (index) *Macoma mitchelli*					
11.	CLAM, SURF *Mulinia*					
12.	COCKLE, GREAT HEART *Dinocardium robustum*					
13.	CRAB, BLUE *Callinectes sapidus*					
14.	CRAB, FIDDLER *Uca pugnax*					
15.	CRAB, GHOST (SAND) *Ocypode albicans*					
16.	CRAB, GULF SPECKLED *Arenaeus cribrarius*					
17.	CRAB, HERMIT *Petrochirus bahamensis*					
18.	CRAB, MOLE (SAND) *Emerita talpoida*					
19.	CRAB, SHORE OR MARSH *Sesarma reticulatum*					
20.	CRAB, STONE *Menippe mercenaria*					
21.	DISK SHELL *Dosinia discus*					
22.	DONAX CLAM (COQUINA) *Donax variabilis*					
23.	JACKNIFE (GREEN) *Solen viridis*					
24.	MOON SNAIL, ATLANTIC *Polinices duplicatus*					

	SPECIMENS	SITES			
		1	2	3	4
25.	MUREX, ATLANTIC *Murex fulvescens*				
26.	MUSSEL, RIBBED *Volsella plicatulus* or *Modiolus demissus*				
27.	OLIVE, LETTERED *Oliva savana*				
28.	OYSTER DRILL, ATLANTIC *Urosalpinx cinerea*				
29.	OYSTER, (GULF) *Ostrea equestris*				
30.	OYSTER, VIRGINIA *Crassostrea virginica*				
31.	PERIWINKLE, MARSH *Littorina irrorata*				
32.	QUAHOG, SOUTHERN *Venus mercenaria* or *Mercenaria campechiensis*				
33.	RANGIA, COMMON *Rangia cuneata* (indes)				
34.	RAZOR CLAM, CORRUGATED *Solecurtus cumingianus*				
35.	SAND DOLLAR *Melita quinquesperforata*				
36.	SCALLOP, BAY *Aequipecten irradians*				
37.	SEA PENS, SAW-TOOTHED *Atrina serrata*				
38.	SHIRMP, MANTIS (MUD) *Callianassa jamaicense*				
39.	SHRIMP, PISTOL *Crangon*				
40.	SUNDIAL, COMMON *Architectonica granulata* *(Nobilis)*				
41.	TELLIN *Tellina alternata*				
42.	TULIP SHELL, BANDED *Fusciolaria hunteria*				
43.	WHELK, LIGHTNING *Busycon contrarium*				
44.	WORM, IODOFORM				
45.	WORM, TUBE DWELLING *Diopatra*				

BEST COPY AVAILABLE

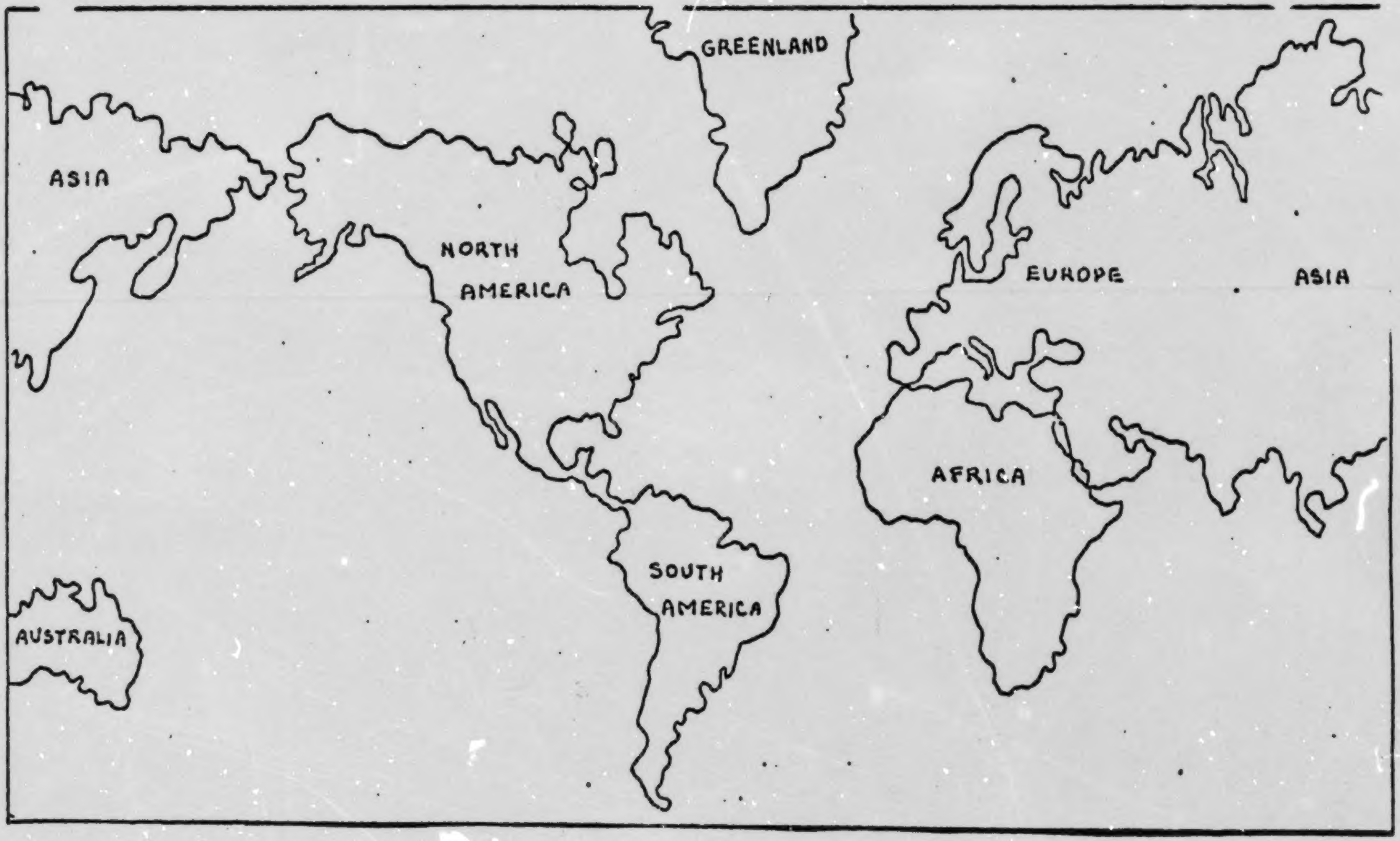
G. SPECIMEN UNIQUE TO THE GALVESTON ISLAND AREA

SPECIMENS	SITES 1	2	3	4	5
NEKTON					
1. ANCHOBY, COMMON Anchoviella mitchilli					
2. ANGIER, DEEP SEA Lophius piscatorius					
3. BLUEFISH Pomatomus saltatrix					
4. BONITO, COMMON Sarda sarda					
5. BOXFISH, SPINY Chilomycterus schoepfii					
6. BUMPER Chloroscombrus chrysurus					
7. CATFISH, GAFF-TOP Bagre marinus					
8. CATFISH, SEA Galeichthys folis					
9. CLINGFISH Gobiessy stramosus					
10. CROAKER Micropogon undulatus					
11. CROAKER, SPOTTED Leiostomus xanthurus					
12. CUTLASS FISH (RIBBONFISH) Trichiurus lepturus					
13. EEL, AMERICAN Anguilla rostrata					
14. FILEFISH, GRAY Cantherines pullus					
15. FLOUNDER, SOUTHERN FLUKE Paralichthys lethostigmus					
16. GOBY, TEXAS Gobiosoma molestum					
17. GRUNT, BLUE-STRIPED Haemulon sciurus					
18. HOG CHOKER Achirus fasciatus					
19. JACK, COMMON Caranx hippos					
20. JACK, YELLOW Caranx bartholomoei					
21. KILLIFISH, BANDED Adinia multifasciata					
22. KILLIFISH, BROAD Cyprinodon variegatus					
23. KILLIFISH, COMMON Fundulus heteroclitus					
24. KILLIFISH, GULF Fundulus similis					
25. KILLIFISH, SAIL-FINNED Mollienisia latipinna					

SPECIMENS	SITES 1	2	3
26. KILLIFISH, STRIPPED Fundulus majalis			
27. KINGFISH, SOUTHERN Menticirrhus americanus			
28. LOOK-DOWN Selene vomer			
29. LEATHER-JACKET Oligoplites sarus			
30. LIZARD FISH Snyodus faetens			
31. MENHADEN Brevoortia tyrannus			
32. MOJARRA, COMMON Eucinostomus gula			
33. MOON FISH Vomer setapinnis			
34. MULLET, STRIPED Mugil cephalus			
35. MULLET, WHITE Mugil curema			
36. PERMIT Trachinotus goodei			
37. PIGFISH Orthopristis chrysopterus			
38. PINFISH Lagodon rhomboides			
39. PIPEFISH, GULF Syngnathus affine			
40. POMPANO, COMMON Trachinotus carolinus			
41. REDFISH (CHANNEL BASS) Sciaenops occellatus			
42. SARDINE, SPANISH Sardinella anchovia			
43. SARGASSUM FISH Histrio histrio			
44. SEA DRUM Pogonias cromis			
45. SEA HORSE, DWARF Hippocampus zostera			
46. SEA ROBIN, SOUTHERN Prionotus tribulus			
47. SHEEPHEAD Archosargus probatocephalus			
48. SHRIMP, BROWN Penaeus aztecus			

BEST COPY AVAILABLE

SPECIMENS	SITES				
	1	2	3	4	5
49. SHRIMP, MANTIS Squilla empusa					
50. SHRIMP, GRASS Palaemonetes					
51. SHRIMP, SEABOB Xiphopeneus kroyeri					
52. SHRIMP, WHITE Peneaus setiferus					
53. SILVERSIDE, TIDEWATER Menidia beryllina					
54. SLEEPER Dormitator maculatus					
55. SPADE FISH Chaetodipterus faber					
56. SQUID, BAY Loligo brevipinnis					
57. STAR-GAZER, SOUTHERN Astroscopus y-graecum					
58. TEN POUNDER Elops saurus					
59. THREAD FIN, 8-FINGERED Polynemus octonemus					
60. TOADFISH Opsanus tau					
61. TONGUEFISH Symphurus plagiusa					
62. TROUT, SPECKLED Cynoscion nebulosus					
63. TROUT,WEAKFISH Cynoscion regalis					
64. WHIFF Citharichthys macrops					


ASIA
GREENLAND
NORTH AMERICA
EUROPE
ASIA
AFRICA
SOUTH AMERICA
AUSTRALIA

Use the map to draw in the mid-ocean ridge, the fracture zones, and the ocean trenches. For extra credit draw in the recent earthquake epicenters.

Mapping the Ocean Floor by Soundings

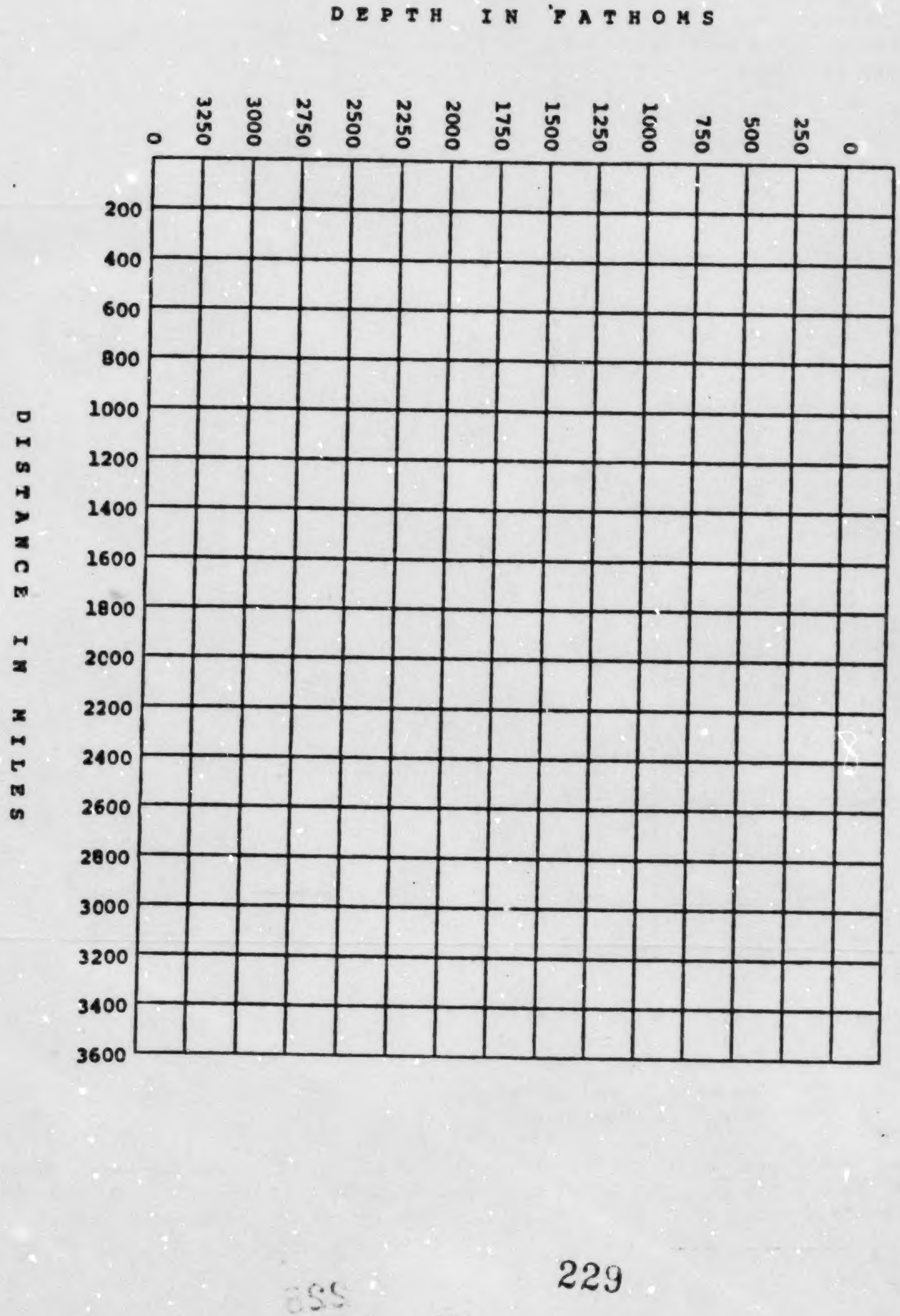
The readings in this activity represent actual soundings taken by a ship as it traveled from Cape May, New Jersey, across the Atlantic to Cape Roca, Portugal. The profile you make will represent the sea floor of the Atlantic Ocean along the parallel 39°N.

	DISTANCE IN MILES	DEPTH IN FATHOMS
(1)	0	0
	100	100
	125	1000
	325	2000
	475	2500
	650	3000
	900	2800
	1125	2900
	1300	3125
	1425	2900
	1475	2000
	1600	1600
	1900	2500
	2000	2100
	2150	1800
	2200	1150
	2225	750
	2325	700
	2450	550
(2)	2475	0
	2525	1000
	2700	2000
	2800	2800
	3150	2700
	3300	2300
	3400	1000
	3425	500
	3475	100
(3)	3500	0

On the Depth/Distance Chart label the following points:

(1) Cape May, New Jersey
(2) Graciosa Island, Azores
(3) Cape Roca, Portugal

Draw in the profile of the sea floor on the chart. Draw a line to represent the ocean surface. Then label the ridge which occurs between 2,000 and 2,800 miles "Mid-Atlantic Ridge." Color the land and water different colors.



DEPTH/DISTANCE CHART

Chapter 11 - Restless Waters

(Time Allotment: 2 days - One Semester)
5 days - Two Semesters)

Major Concepts to be Taught

Circulation of ocean waters
The causes of waves
The causes of tides
Shore processes and deposits

Instructional Objectives

The student should be able to:

- identify the causes and types of ocean currents
- describe the pattern of movement, identify the features, and recognize the shallow water characteristics of waves
- explain the causes of the tides and compare and identify spring tides, neap tides, high tides, and low tides
- associate erosional forces with the shoreline processes and recognize the characteristic features of shore deposits

Assessment Guidelines

The student will:

- List the causes of the ocean currents.
- Describe the action or characteristics of two of these types of currents:

    deep ocean currents
    upwellings
    surface currents
    density currents
    turbidity currents

- Label on a drawing of a wave the crest, trough, and wave base.
- Explain by diagraming how to measure the length and height of a wave.
- Name four factors that determine the height of a wave.
- Define tsunami.
- *Define tides and explain how they are caused.
- Explain why spring tides are higher than neap tides.
- Explain how water action at the shore zone can be both constructional and destructional.
- Describe four of these shoreline deposits: berms, barrier island, lagoon, spits, bars, beach.
- On a coastline drawing locate the following: berm, barrier island, lagoon, spits, bars, beach.

Materials

Textbook: Focus on Earth Science, pages 200-219

Earth Science Skillcards:

- No. 67 - Oceans - Waves for section 12:3 page 228

Lab Manual: "Earth Science--A Learning Strategy for the Laboratory"

- No. 34 - Density Currents

Earth Science Activity-Centered Program, Teacher's Guide

- Page 84 - Extensions to Activity 11-1
- Page 85 - Additional Activity
- Page 87 - Additional Activity
- Page 90 - Extensions to Activty 11-2

Additional Suggestions:

- A, B, C, pages 217-219
- Points to Remember, page 217
- Words to Use, page 217
- How and Why, pages 219
- More Ideas to Explore, page 219
- Collect pictures of waves and shoreline features
- Work with maps of the Texas Gulf Coast

Focus on Earth Science Review and Reinforcement Guide

- 11:1 - Shoreline Features, page 55
- 11:2 - Ocean Current Patterns, page 56
- 11:3 - Calculating Wave Speed, page 57
- 11:4 - Restless Water Word Search, page 58

Films:

- 6008 - Seacoasts (1973) 10 min
- L2365 - The Restless Sea (Parts I and II)
- M3441 - Tides of Fundy
- M5231 - How Level is Sea Level

PERFORMANCE OBJECTIVES

The student will --

Identify the causes and types of ocean currents.

SUGGESTED ACTIVITIES

@ Using the map in this guide, have students make an imaginary journey in which they cross the Labrador Current, Gulf Stream, Equatorial Countercurrent, South Equatorial Current, Atlantic Current, and Brazilian Current and return to their starting point. Have them list the time zones and the wind zones which they cross. These journeys could be conducted individually or as a game. The first student may go through one time zone and then call on some other student to continue either through a time zone or another current.

On an outline map of the world, draw the major ocean currents. Compare them with the wind belts of the world. Note any similarities or differences. This activity is similar to the one above. This activity could be completed by all students, whereas the activity above would probably be more challenging.

*Have students do the activity on page 202. This activity lets the students make currents similar to those found in the ocean.

Using a map of the ocean currents, discuss the questions on pages 84-85 in the Activity Book.

Have students do Ocean Current Patterns, on page 56 of the Review Guide. Students could do Lab No. 34 - Density Currents, page 77 of the Lab Manual.

Some students could make a poster or bulletin board display showing the Gulf Stream with all its component currents and report in more detail about its discovery and importance to mankind since 1492.

*Students could do the activity "Density Differences." Give students copies of the procedure.

Assign students to research and report to the class on the operation of the Nansen Bottle.

Students could report on different forms of life in each layer and any which live in several layers.

Students could make a map showing turbidity currents.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Explain the causes of tides, and compare and identify spring tides, neap tides, high tides, and low tides.	Refer to "An Investigation of Tides: Are They Related to the Moon?" found in the Appendix. This information is interesting and could be helpful to you for the teaching of this concept.
	Have the students report to the class some of the great "tidal waves" in history (tsunamis). Be sure to include the waves which followed the explosion of the island of Krakotoa, and recent earthquakes.
	*Have students keep a graph or chart for one month (one complete cycle of moon phases) of the tides in the Gulf, using the tide table in the newspaper.
	Have a volunteer write to the United States Coast and Geodetic Survey offices in Galveston for information regarding the location of the tide gauge there.
	Films: The Tides of Fundy, The Restless Sea, Parts I and II
	Activity on page 235 has the students compare the cycle for high and low tides.
	Make a drawing in notebook of Figure 11-6 on page 207. Helps them associate the position of the sun, moon, and earth during spring and neap tides.
	Students can read about the problem of subsidence in the bay area and discuss the causes and possible solutions. Collect pictures that have been taken at high tide.
Describe the pattern of movement, identify the features and the shallow water characteristics of waves.	*Skillcard No. 67 - Waves. This activity helps the students compare the movements of particles in water with the movement of waves.
	*Activity on page 2$ demonstrates how ocean waves are produced.
	*Collect pictures of different types of breakers and compare them with the shoreline features.
	Read about tsunamis to determine how they occur, how they are detected and plotted, and the destruction they cause.

BEST COPY AVAILABLE

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Have students time their waves with a stopwatch and use the following formula to determine wavelength. Wave speed = $\frac{\text{wave length}}{\text{wave period}}$. See page 91 of the Activity Book for more details. A similar activity would be calculating wave speed on page 57 of the Review Guide. Have students research and report on the effects of tsanamis of the Pacific Ocean in the past 200 years. Have students to check the sport of surfboard and how surfers use waves.
Associate erosional forces with the shoreline processes and recognize the characteristic features of shore deposit.	Refer to the article in Appendix on "Galveston Bay." @ Lab No. 32 - At the Beach. Get maps of the Gulf Coast and the Texas Gulf Coast. Have students define barrier island, bars, spits, lagoons, bays, and then have them identify these features on the map. (They should realize that Galveston is a barrier island.) *Collect pictures of the different types of coastline features and compare wave action and deposits. Students could do Exercise 11:1 Shoreline Features, page 55 of the Review Guide. Compare shore erosion along rocky shores and sandy shores, and have students name features of each type. @ Students could get a map of the Gulf of Mexico and connect all equal fathom depths. From this they may be able to locate sand bars, continental shelf, continental slope, and other features. Have students draw diagrams to show the difference between a coast along which notched cliffs, stacks, caves, etc. are formed and a coast where beaches, spits, bars, and barrier islands are present. Topographic maps are helpful in illustrating shore features. If any students would like to find out more about careers that have to do with the ocean, they may wish to write to the following agencies for more information:

PERFORMANCE OBJECTIVES | SUGGESTED ACTIVITIES

The student will --

American Society of Limnology and
Oceanography, Inc.
Kellogg Biological Station
Hickory Corners, MI 49060

American Society for Oceanography
854 Main Building
Houston, TX 77002

International Oceanographic Foundation
1 Rickenbacker Causeway, Virginia Key
Miami, FL 33149

National Oceanography Association
1900 L St., N.W.
Washington, D.C. 20036

U.S. Naval Oceanographic Office
Washington, D.C. 20390

Have students do Focus on Careers on page 216.

Do exercise 11:4 - Restless Water Word Search.

NAME____Period__________ Date____________________

Experiment ________: Oceanography

Purpose: To perform two simple experiments related to various topics in oceanography.

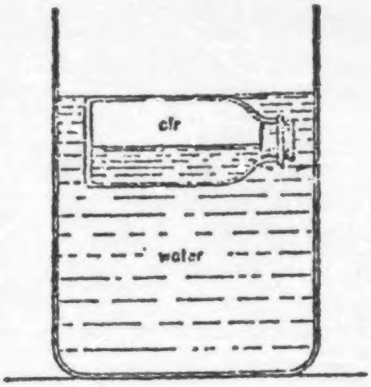
Materials:
- small bottle or test tube with tight-fitting cap or stopper
- red ink or dye
- 1 small beaker
- 1 large beaker or battery jar
- 1 medicine dropper
- water

Procedure One:

Making a Float Bottle

A "float bottle" will float just below the surface of the water, where it will be moved by ocean currents but not by winds. It is used to study the movement of ocean currents.

Fill a small bottle or test tube with water. Cover it tightly with a cork. Place it in a battery jar of water and note how rapidly it sinks to the bottom. Remove it. Now carefully pour out water, a little at a time (or use a medicine dropper), testing the "bottle" each time until it just floats fully submerged.



Procedure Two:

Density Currents

A density current is a current that moves beneath the surface of less dense water.

Add a few drops of red ink or a liquid dye to a strong solution of common salt in a small dish or beaker. Slowly and carefully pour this dense water - the color of which will enable you to follow it as it moves - into the side of a battery jar or large beaker of ordinary fresh tap water. Observe its flow. (A medicine dropper may also be used to introduce the salt water into the fresh water.)

Note:

Density currents are movements in water which the equatorial waters move toward the poles. The cold water at the poles sinks and moves toward the equator.

Questions:

Questions 1 - 3 refer to Procedure One.

1. How many times did you have to remove or add water for your bottle to float as directed?
2. Measure the amount of H20 in the bottle in a beaker. How much water was in the bottle when the experiment finally worked?
3. What did you learn from this experiment?
4. What do you observe about the flow of the dye?
5. What does this tell you about ocean currents?

Conclusions:

1. Compare Procedure One with Procedure Two. Which one did you like better? Why?
2. From which one did you learn more? Why?